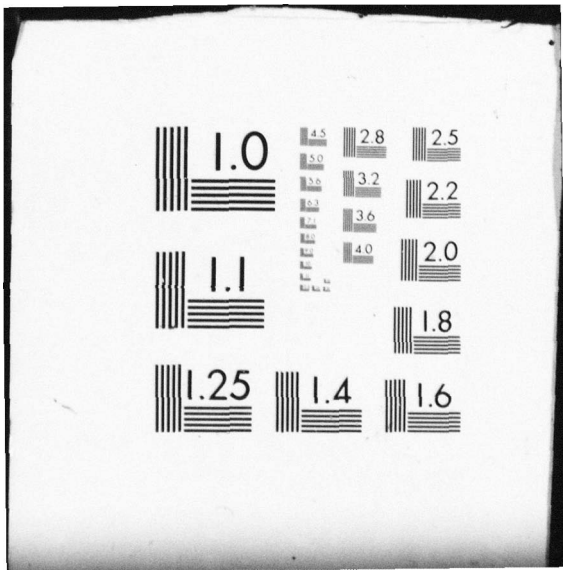
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12 OCT 79

AFMSMET REPORT 78-5.1
WILLIAM F. DRAKE III
AND
LT RAYMOND C. REISS

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ABSTRACT

The Logistics Composite (LCOM II) simulation software is a composite of individual programs or modules written in SIMSCRIPT II which communicate directly with each other and function as a unit. This software was designed to apply simulation to studies concerning Air Force base level functions, e.g. operations, maintenance, and supply. Through simulation the impact of the availability of all types of support resources on the operational status of a weapon system can be assessed. The LCOM II software together with the data representing a weapon system's environment form study models that permit the analysis of weapon system support requirements.

The LCOM II simulation software is composed of 4 distinct modules; the Input Module that processes the data, the Main Module that conducts the simulation, the Restart Module, and the Post Processor Module that includes several individual post processor programs providing post simulation analysis and data displays.

All modules of the LCOM II simulation software are described in detail, their data input requirements specified, and application methodology and procedures are prescribed. All output products are described in detail, and a step-by-step approach for preparing the input forms is discussed.

PREFACE

The Logistics Composite (LCOM II) simulation software is a system of computer programs written in SIMSCRIPT II designed to apply simulation to studies concerning Air Force base level functions. The original "Logistics Composite Model User Reference Guide," AFLC Report 70-1, was published in January 1970. A "Logistics Composite Model User Reference Guide Update," AFLC/ADDR Report 74-1, was published in November 1974. Both documents were placed in the Defense Documentation Center, Cameron Station, Virginia, under the respective assigned numbers AD-703-328 and AD-A003-211. Those two documents describe the original LCOM programs which were written in SIMSCRIPT I. Upon conversion of the software to SIMSCRIPT II and completion of major enhancements, the "LCOM II Standard System Version 1.2 User Documentation" was published on 15 November 1977 to update the two previous documents and establish the preliminary LCOM II user documentation.

The "LCOM II Simulation Software Users Reference Guide", AFMSMET Report 78-1, was published on 1 May 1978 and completely described the LCOM II simulation software Version 2.0. It combined information from all three previous documents, an LCOM II briefing, and applicable portions of LCOM II program documentation. It superceded all previously published LCOM I and LCOM II user reference documentation.

AFMSMET Report 78-5 is essentially a significant update to Report 78-1 and describes the LCOM II Version 3.5 released for Air Force use in December 1978. This report describes all new features and enhancements, changes necessary for system standardization, and a new sample problem, that collectively upgrade the LCOM System to Version 3.5.

Note that the differences between Report 78-1 and 78-5 are highlighted by a vertical line along the edge of the page. However, minor editorial and major computer output product changes such as those in Chapter IX will not be so indicated. Appendix A, B, and C have been completely rewritten and will only be marked beside the appendix number itself. The additional August 1979 updates to 78-5 are highlighted by a dashed vertical line along the edge of the page. The previous highlights remain intact except where changed again with the August 1979 updates.

When using LCOM II Version 3.5, it will be necessary to use this document, Report 78-5, not Report 78-1. However, Version 2.0 data bases are completely upward compatible with the exception of the way generalized resource substitution is activated and a few Change Cards. Comments and suggestions concerning this document are solicited. Address comments to AFMSMET/MEMT, William Drake, WPAFB, OH 45433.

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ACKNOWLEDGEMENTS

There were so many individuals whose contributions aided in the successful completion of this publication. I wish to thank them all, but it would be nearly impossible to name them individually without some omissions. Every organization involved in using LCOM, particularly those discussed in Chapter 1 provided inputs, comments, etc. The members of CACI, Inc. also contributed their collective expertise.

However, there were several individuals whose contributions were of a significant nature. Of these, several were AFMSMET personnel.

The expanded scope of Report 78-5; with respect to its predecessor Report 78-1, is due primarily to the number of improvements made to the LCOM II software. Ms Barbara Wieland's contributions to these improvements were extensive. She was primarily responsible for the improvement in the Main Module run time efficiency which will result in a substantial saving in computer cost to all users. She reduced the complexity of the Post Processor Module and added many new features to it and the Input Module. In addition, she contributed heavily towards the excellent quality and technical competence of this report.

The expanded sample problem was developed and tested by Mr. Edward Dudzinski and provides a significantly improved test case for implementation checkout and continued testing of LCOM II.

The excellent typing support provided by Ms Cheryl Plantz encompassed changes to approximately 2/3 of Report 78-1.

The August 1979 update to this user's guide was a significant improvement to the completeness and accuracy of it, including the addition of the new Support Equipment Post Processor. Ms. Wieland was totally responsible for these quality changes.

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1. INTRODUCTION

A. Background

The environment of increasingly complex weapon systems and equally complex support systems has created a requirement for improved scientific tools to assist in the evaluation of these systems. A technique was needed that permitted a systematic approach to analysis of the support requirements for complete weapon systems. Computer simulation was selected as the best means of analyzing support systems on an item-by-item basis in terms of their effect on operating performance. Although the initial interest was in logistics support areas, simulation further permitted an across the board analysis of other types of support resources, i.e., men, test equipment, etc.

Logistics Composite (LCOM) software employs simulation to analyze the impact of all types of support resource shortages on the operational status of a weapon system. The LCOM software together with the data representing a weapon systems environment form study models that permit the analysis of the weapon systems support requirements.

Development of LCOM Simulation Software began in November 1966 as a joint effort between the Air Force Logistics Command (AFLC) and the Rand Corporation, Santa Monica, California. The software development was transferred to AFLC in 1967, where it was completed and implemented on the UNIVAC 1107. The foremost consideration in LCOM software development was to efficiently utilize computers to address an optimized support resource environment. Attainment of this goal is a primary reason for the continually expanding use of the LCOM system.

Use of the LCOM Simulation Software in areas other than logistics was begun at the Tactical Air Command (TAC) in 1971. This introduced the manpower community to a tool that provided a significant aid in the development of Air Force aircraft maintenance manning standards. Also, LCOM simulations allowed wartime manning standards to be evaluated in a manner not possible before.

Subsequently, the Air Force Human Resource Lab (AFHRL) and the Air Force Systems Command (AFSC) began in 1972 to use LCOM Simulation Software in the area of weapon system procurement. With Simulation Software, they were better able to consider the impact of trade-offs between the various types of resources prior to and during the early weapon system acquisition. The impact of decisions at this point in the life of a weapon system is a key factor in reducing total weapon system cost.

LCOM Simulation Software use was further extended to the weapon system test and evaluation phase thru the efforts of the Air Force Test and Evaluation Center (AFTEC) beginning in 1974.

With the role of LCOM Simulation Software expanding there was an increased requirement for improvement in the software and for a single point to control its maintenance. The initial step in that direction was the establishment of an LCOM Steering Group consisting of all major users. Subsequently, major improvements were made during a contractual conversion of the LCOM Simulation Software from the SIMSCRIPT I to the SIMSCRIPT II programming language. This effort was sponsored by USAF/LG between March 1975 and June 1977. This conversion improved the efficiency and added many new user features, resulting in the software now called LCOM II. The software was implemented on both the Honeywell 600/6000 and CDC 6600/7600 computers.

The Air Force Maintenance and Supply Management Engineering Team (AFMSMET) located at Wright-Patterson Air Force Base was assigned the role of system caretaker in 1977 and is responsible for the Air Force wide implementation and manpower usage of software.

In the latter part of 1978 the LCOM II software was implemented on the ITEL AS/5 (IBM 360 compatible) computer. In conjunction with this reimplementation the software was standardized where possible across the Honeywell 600/6000, CDC 6600/7600 and the ITEL AS/5 computers. Concurrently, improvements were made in the softwares, efficiency and memory requirements.

B. Role of Simulation

The utilization of support resources (personnel, equipment, spare parts, etc.) and the impact of their shortage on the operational status of the weapon system is a function of probabilistic occurrences. Simulation is the most direct approach for considering the stochastic nature of the support processes in determining a best mix of resource levels that would effectively support a given weapon system flying program.

For evaluation analysis, a simulation model can compare the benefits to be realized from alternative support postures in terms of resources and repair capability. This requires an established scenario and support posture with subsequent trials varying one or more factors under consideration. For example, given an operational scenario and resource posture, the flying program can be successively incremented with typical or random flying schedules until a prescribed level of operation effectiveness can no longer be supported. This method can be employed to approximate the system "break-point," that is, the level of operations that is the limit of supportability. Conversely, the flying schedule may be held fixed and the resource posture can be successively altered until desired operational effectiveness is obtained. Similar evaluations can be made by varying other factors of the overall support system.

Simulation is an effective tool for system analysis. It cannot, however, be used without caution. Any decision maker will require sufficient facts on which to base a decision. A simulation model does not refuse to give answers simply because all the factors are not present or are invalid for the analysis being attempted. The user of simulation models must be confident that all the relevant factors are present in his input, that there is a reasonable degree of accuracy and representation, and that his abstraction of factors does not bias the results. Where there is uncertainty, the model can serve to test the sensitivity of the results to the abstractions. If the results are not sensitive, the user can be assured that his estimates will not seriously bias his results.

C. The LCOM Simulation Software and Weapon System Models

Numerous simulation models have been developed that address the area of aircraft operations, maintenance and supply. These models have, for the most part, been problem oriented in that they did not have an appropriate balance in the representation of the environment. Other attempts have successfully achieved a better balance but not in a single model. Maximum flexibility of representation is required in a support resource model.

The LCOM Simulation Software attempts to leave maximum control over the detail of data representation up to the user, so that he may design his own model environment and the balance he believes to be necessary for his problem. The software is designed to process spares on an item-by-item basis or where the user is more concerned with operations, permits him to abstract the support system and treat an aggregate of spares in the form of sub-systems. Therefore, the weapon system models developed can more readily be tailored to the requirements of the study being conducted.

With such user control of the environment description, various weapon system models can be developed using the same LCOM Simulation Software. The commonality of software inputs, simulation techniques used, and output products provided, contribute to the standardization of study techniques and data analysis.

In summary, the LCOM Simulation Software is designed to more adequately represent aircraft operations, the resulting demands for support resources and the interactions involved in the demand process, within the framework of a single weapon system model operable on current generation computers.

D. Validation Requirements

Once designed and developed, a weapon system model must be validated prior to acceptance of simulation results. This process of validation is not a simple one to define. Historical and statistical validation are two important methods.

Historical validation is the comparison of simulation results with the real world results from the weapon system being simulated. This is not always possible when dealing with situations not readily observable, such as of a new weapon system or of wartime operations. However, historical validation of peacetime conditions can and have been accomplished. With these as a basis, extrapolations to other conditions can usually be made with acceptable results.

Since numerous historical validations have been accomplished in the past involving several different weapon systems, the basic LCOM Simulation Software has, in effect, been through a vigorous validation. With each additional historical validation, the solidarity of the software logic is again reverified.

In addition, over the past several years many statistical validations of the weapon system models developed with LCOM Simulation Software have proved the stability and accuracy of the software logic itself. The outputs have been analyzed and compared through application of spectral density analysis. Other standard statistical techniques have also been applied to the software results. No outstanding faults were evidenced.

Finally, model validation has been aided through the development of quality control procedures on model development and the use of graphic and statistical evaluation of data inputs.

E. Software Stability

Throughout the years of LCOM Simulation Software usage the basic philosophy has not changed. The methods used to establish and process the users environment, the aircraft operation control feature, and the method of support resource interaction have all remained very stable. Necessary improvements on these and other salient features of the software have occurred and software optimizations have been accomplished.

Improvements to the LCOM simulation software, have always considered upward data compatability, where possible, as a prerequisite. Many of the input data forms have not been changed or only slightly modified. However, some additional forms have evolved during the improvement process.

II. GENERAL DESCRIPTION

A. The LCOM II System

The LCOM II Simulation Software described herein can be applied directly to the development of weapon system models without the requirement for any additional programs. However, continual use of the software over the past few years has resulted in the development of auxiliary support programs. The Simulation Software is the major component of a total system referred to as the LCOM II System. Figure 2-1 shows the system's structure which is composed of the two major parts; the LCOM II Simulation Software and the LCOM II Auxiliary Programs. The LCOM II Auxiliary Programs are valuable aids in data development and analysis. However, they are not required in order to develop a weapon system model with the simulation software or to conduct a simulation study using the software. The user documentation of these auxiliary programs will not be included in this document, but will be published under separate cover since various organizations have developed and documented their own auxiliary programs.

B. Simulation Software Structure.

The LCOM II Simulation Software was developed as a composite of individual programs or modules which communicate directly with each other and function as a unit. As seen in Figure 2-1, the software is composed of four modules; the Input Module, Main Module, Post Processor Module, and Restart Module. The specific functions of the total simulation process included in each module is also shown on Figure 2-1. The basic communication and interfaces between the modules is reflected in Figure 2-2. A more detailed view of these and other user interfaces is described in Appendix A. This appendix describes the current computer implementations, proper job control language requirements, and test case results as an aid in implementation and checkout of the software.

Figure 2-2 shows the passage of two data files from the Input Module to the Main Module. These files are called the Initialization file (contains the environment description) and the Exogenous file (contains the mission, sortie and activity processing requirements).

The Main Module directs a single file of detailed transaction data to the Post Processor Module. However, data placed on this file must have first been requested by the user. It is not automatically generated. The Main Module produces a restart checkpoint tape to pass to the Restart Module. It also must be user requested and operated only on the Honeywell 600/6000 computers.

1. Input Module Functions. The primary function of the Input Module is twofold:

a. It is a translator that reduces and reformats the data provided by users on easy to use input forms into a data structure that is suitable for use by the Main Module. This is called Initialization.

b. It is a sortie generator permitting the user, by exercising available options, to specify a flying and activity program that will exercise the support system in the Main Module. The flying program is defined in terms of missions and/or activities requiring specific types and quantities of aircraft or non-aircraft resources.

The Input Module will edit the input data and provide diagnostics where inconsistencies are found in the data. In some cases where ambiguities are found, assumptions will be made as to what the user intended to insert and a message will be provided giving what was found and what assumption was made. This feature prevents loss of an Input Module run when the assumption might be acceptable. In more serious cases, where such an assumption cannot be made, the execution is terminated after all data has been edited. These checks or edits are by no means exhaustive but cover a wide range of possibile errors and are a valuable feature of the Input Module. However, the logical intent of a user is one area that cannot easily be checked or any assumption made.

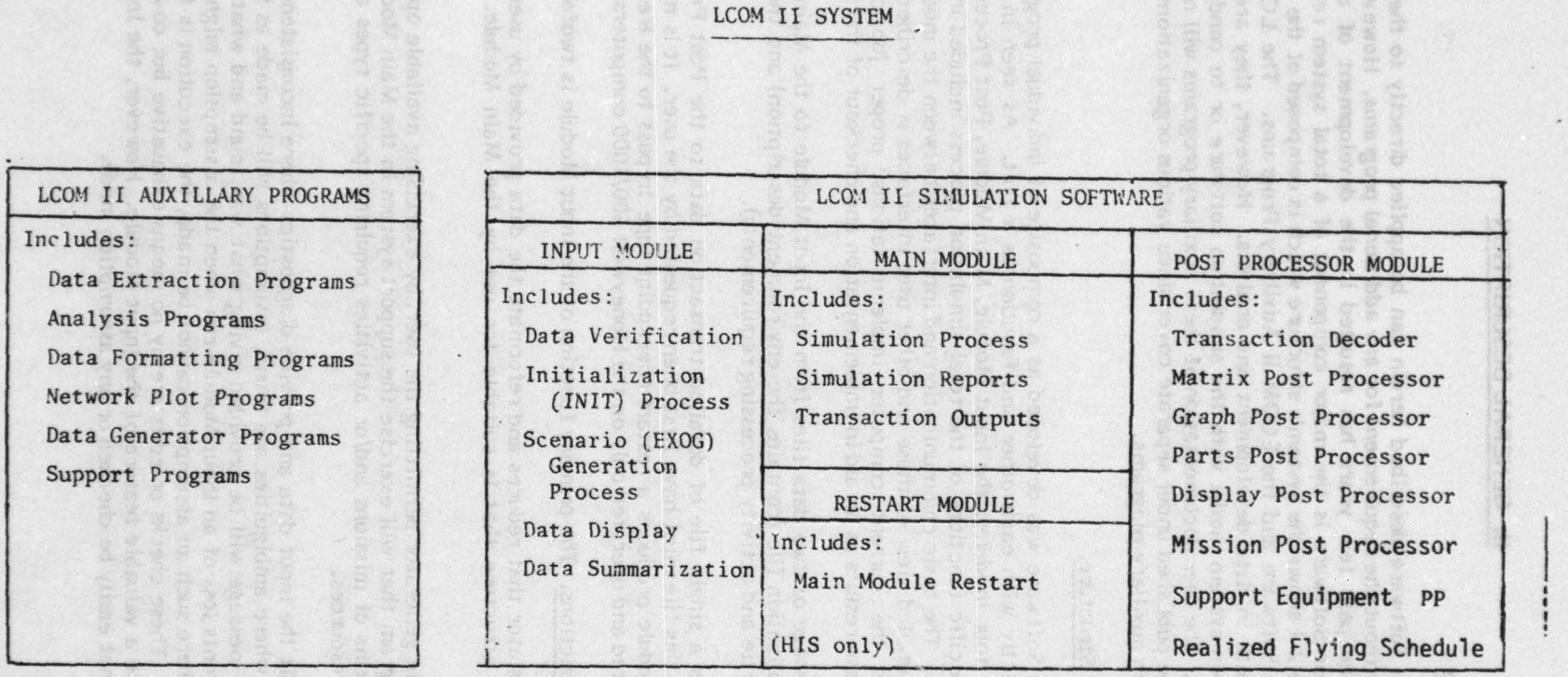


FIGURE 2-1 LCOM II SYSTEM STRUCTURE

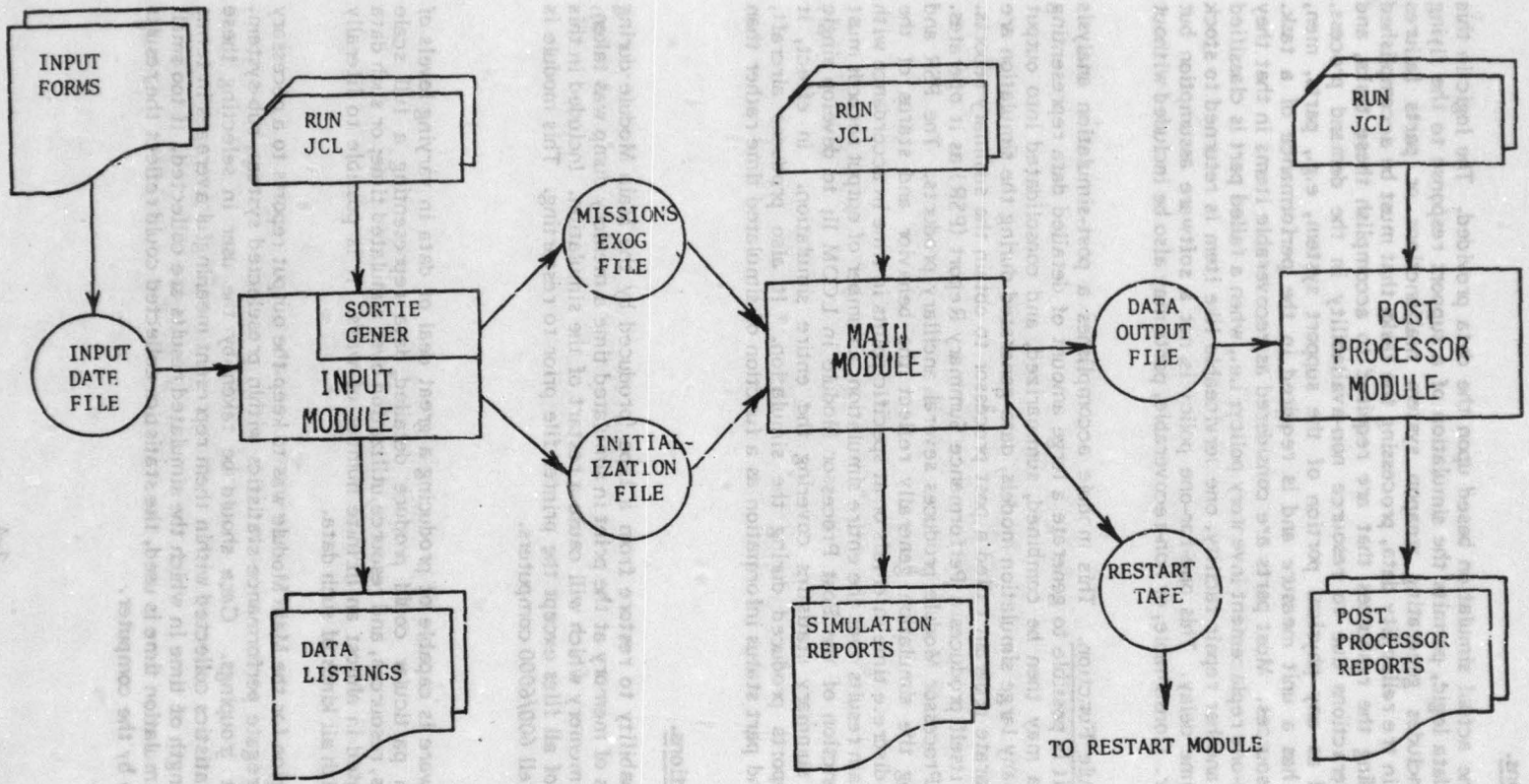


FIGURE 2-2 BASIC LCOM II SIMULATION SOFTWARE MODULE INTERFACES

2. Main Module Functions.

The Main Module conducts the actual simulation based upon the data provided. The logic in this software, together with the data logic, permits the simulation of a support response to the flying schedule. This response includes generating weapon system malfunctions or parts failures corresponding to those found in the reliability data, processing the tasks that must be accomplished for their correction, demanding the resources that are required to accomplish these tasks, and controlling the resultant interactions due to resource non-availability in the demand process. Resources may be described as any physical portion of the support system, e.g., parts, men, equipment, or anything that has a unit measure and is required in the performance of a task. Aircraft are considered as resources. Most parts are considered as recoverable items in that they are replenished with a one-for-one replacement inventory policy; i.e., when a failed part is classified as non-reparable and sent to another repair facility, one serviceable like item is returned to stock after an order-and-shipping time delay. This one-for-one policy is not a software assumption but must be networked by the user. Consumable, or non-recoverable, parts may also be included without a batch replenishment policy.

3. Post Processor Module Function. This module accomplishes a post-simulation analysis function. During simulation, it is possible to generate a large amount of detailed data representing simulation results. The data may then be combined, summarized, and consolidated into output reports of various kinds. In many large simulation models, data generated during the simulation are processed afterward by a separate program called a post processor to obtain the summary reports. In LCOM II, the Main Module itself produces a Performance Summary Report (PSR) as it operates. However, the separate Post Processor Module produces several ancillary products. The PSR and other reports produced during the simulation generally reflect the behavior and status of the simulated environment during discrete time intervals or at specific points in time in accordance with the reporting interval. To obtain results over the entire simulation, a number of output records must be inspected. This is the function of the Post Processor Module in LCOM II; to develop single products displaying selected summary statistics covering the entire simulation. In effect, it consolidates the periodic reports produced during the simulation. It also produces aircraft, manpower, mission, sortie, and part status information as a function of simulated time rather than at specific points in time.

4. Restart Module Functions.

This module provides the capability to restore from a tape (produced by the Main Module during simulation) the entire contents of memory at the point in simulated time a memory dump was taken, and return to a fixed point in memory which will cause a restart of the simulation. Included in this is the complete repositioning of all files except the printer file prior to restarting. This module is only applicable on the Honeywell 600/6000 computers.

5. Report Philosophy.

The LCOM II Simulation software is capable of producing a great deal of data in varying levels of detail. The Main Module in particular could produce detailed data representing a full scale accounting of all missions, jobs, resources, and resource utilization over simulated time; or such data could be combined or aggregated in almost an infinite number of ways. It is possible to literally flood a user of the software with all kinds of such data.

However, a major design criterion for the Main Module was to keep the output reports to a necessary minimum and confined to aggregate performance statistics within preselected system, sub-system, specialty code, or equipment groupings. Care should be taken by the user in selecting these groupings to assure that the statistics collected within them represent meaningful averages in terms of the sample sizes and the length of time in which the simulated results are collected. If too small a sample size or insufficient simulation time is used, the statistics collected could reflect the results of unusual random draws made by the computer.

For these reasons, only the main PSR reports are automatically produced for the user. Other user reports are available on both a specific time basis and a time aggregation basis. These reports must be selected and scheduled by the user. Some additional programmer reports are also selectable, but in these cases the volume of output is often significant. Selection of these user and programmer reports should be based upon the need for the data to be produced. Such a need might be when a particular summary statistic is out of line, or inconsistent with other results. In such a case, detailed data may provide clues as to how it happened and may point out input data errors or malfunctions.

Each of the modules contained in the LCOM II Simulation Software has its own set of output reports which are described in the appropriate chapters. In each case, the report is identified as to whether it is automatically produced or requires a user to explicitly request its output.

C. Basic Philosophy of Logic Input.

In order to obtain the necessary versatility of being able to apply LCOM II to a wide range of weapon systems, a new concept in model design was used. That concept was to have the majority of the simulation logic provided externally in the data (between 80% and 90%), rather than have it as an inherent fixed part of the software itself. To implement this "User Provided Logic" concept, a network technique was used. This network approach permits a description of the sequence of necessary tasks or events required to complete the processing of the particular item or activity being studied. This users guide will explain how this network technique is applied and how it provides the necessary flexibility for describing the logic of an AF base environment, regardless of the weapon system involved.

D. Internal Software Functional Logic.

Figure 2-3 represents the basic flow logic within the Main Module. This is in terms of the relationship of the various key network segments. During the simulation process, an attempt is made to complete each mission requested. This is done by obtaining the needed aircraft from a ready pool and beginning their processing through a set of user defined pre-sortie tasks. This is started at the time the mission is requested. A take-off and cancellation time is also established by the mission request. Once the required aircraft complete the set of pre-sortie tasks and the take-off time is reached, the aircraft begins the sortie task (flies the sortie). Upon completion of this task, the aircraft must undergo the defined post-sortie tasks. When completed, the aircraft are returned to the serviceable pool. The time to cancel will be utilized only if insufficient aircraft are ready to fly the mission, or if the pre-sortie tasks cannot be completed in the allotted time.

In addition to this basic mission/sortie timing logic, the Main Module contains two additional areas of built in logic. One is the network processing logic that permits entry into a piece of network and insures the proper processing of all tasks within the network, based upon the user supplied task selection logic. Upon completion of any portion of the network, logical processing transfers to the next portion of the networks as defined and structured in the data. Finally, the statistic collection logic in the Main Module is oriented toward the logical hierarchy of the base environment. This is the only reason that LCOM II is a base model, because it collects base type statistics. The remainder of the logic in the Main Module is in the implementation of the particular features which are primarily user selectable and require the addition of extra data.

E. User Supplied Logic Networks.

The pre-sortie and post-sortie blocks in Figure 2-3 represent sections of logic the Main Module processes. These are, as indicated, user supplied logic networks. Pre-Sortie networks could include tasks such as preflight checks, weapons loading, etc. Post-Sortie tasks might include fuel service, post-flight inspection, unscheduled and scheduled maintenance, etc. Tasks within these networks will define the resources required to do the task, priority of work relative to other defined maintenance, and their relationship to succeeding tasks.

The detail of the task networks are entirely under user control and are limited only by the availability of data and computer memory required to process the task networks. A detailed description of network construction is provided in Chapter IV.

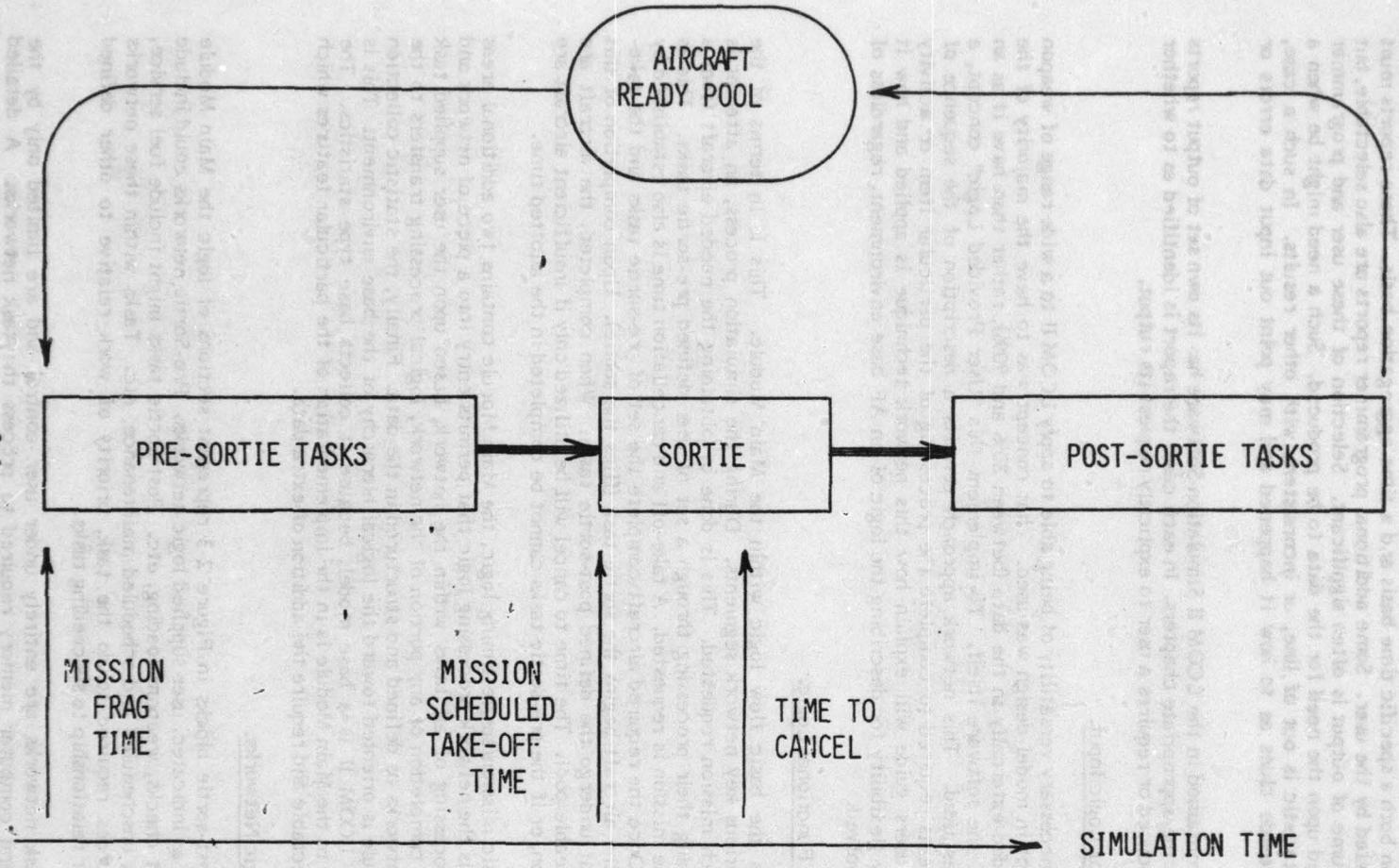


FIGURE 2-3 MAIN MODULE FLOW LOGIC

III. INPUT MODULE

A. General Description

The general function of the Input Module is to translate user supplied data into a form which can be used by the Main Module of the LCOM II Simulation Software. The relationship of this module to the Main Module was depicted in Fig. 2-1.

The user provides the data that describes the operating environment for the simulation on a set of pre-printed input forms. The information on the forms is then transcribed onto punched cards or permanent files to form the "input data." This input data is then read by the Input Module.

The Input Module performs two independent functions: (1) The portion of the input data comprised of all forms except Form 20 is edited and converted into the initial conditions file generally referred to as an "Initialization". At the same time, extensive error checking is performed and an edited listing of the input data is printed. This listing includes diagnostic messages if any, notifying the user of input data which is either in error, has been omitted, or found to be inconsistent with other data. (2) The portion of the input data comprised of the Form 20s is edited and produces an "exogenous events tape." This tape contains all mission and activity requirements by type and time of day, for the entire duration of the simulation. It is read during the actual simulation and is the means by which external demands are imposed on the simulated system. It should be noted that these two portions of the input data deck can be and are quite often run separately.

Reformatted data from the Input Module is used by the Main Module and Post Processor Module which are fully described in Chapters IV and V, respectively. The input data requirements for each module are also covered in these chapters while the specific instructions for filling out each of the input forms are described in Chapter VIII.

The remainder of this chapter will define the input forms, describe certain features and conventions which are common to all input forms, and describe the Initialization and the Sortie Generation processes.

B. Input Forms

The Input Module uses data input on 13 different forms. Each form has a specific purpose and permits entry of common types of data. Some of the forms are optional in that they are not required, e.g. Form 15 empirical distributions. The specific user options will be further explained when discussing the particular form itself in Chapter VIII. All the forms are listed in Table 3-1 along with a very brief purpose.

Table 3-1 Input Forms - Data Types

Data Type	Form Name	Purpose
10	Performance Summary Report	Defines report structure.
11	Task Network	Inputs task network.
12	Task Definitions	Defines task parameters.
13	Resource Definitions	Defines all resources and clocks.
14	Failure Clock Decrements	Defines task/clock relationships.
15	Distributions	Inputs empirical distributions.
16	Shift Change Policies	Defines authorizations by shift.

17	Mission/Activity Entry Points	Defines resources entering network and required configurations.
18	Priority Specifications	Inputs priority systems parameters.
20	Sortie Generation	Inputs mission/activity parameters.
21	Aircraft Assignment Search Patterns	Defines external and internal configuration search sequence.
22	Internal Equipment Authorizations/ Changes	Defines internal equipment, their authorizations, and trigger node effects.
23	Internal Equipment Group Definitions	Defines internal equipment groupings by quantity.

C. Common Input Form Features - See Appendix F for Form Masters

1. Data (Form) Types - Header Requirement

Each input form is identified by a "data type" in columns 2 and 3 which is the same as the form number. All the LCOM II forms are listed in Table 3-1. When preparing a data set, all data records of a similar type are grouped together. Each group of data records must be preceded in the input data by a header record which has the same data type in columns 2 and 3. The remainder of the header record through column 73 may contain any information, but this information is ignored by the program. In the records following the header record, columns 2 and 3 may be left blank, thereby defaulting the card type equal to the preceding card.

2. Control Character

Normally the first column of each record in the input data is blank, but can at the user's option, serve as a printer carriage control. These characters control the spacing of the input data during processing and are as follows:

Character	Meaning
blank	Normal spacing, new line for each data entry.
0	Skip one line before printing data.
1	Eject page before printing data.

3. Naming Conventions

On the input forms, tasks, resources, clocks, nodes, missions and several other data items are identified by "names." These names may be up to six characters in length and may consist of letters, numbers, and special characters in any combination. Imbedded blanks are considered to be part of the name, but leading or following blanks are ignored. Examples of typical names are: RES21, C5000, TOW, RF-4C, CLSPT.

When filling out the input forms, the names may be placed anywhere within the designated field (if the name is less than six characters). The program will automatically left-justify all names. Thus, the names "bbABCb" and "ABCbbb" are equivalent where b designates blank spaces.

4. Numerical Data Fields

Numerical fields are flexible as to the types of data which will be accepted. The user does not need to concern himself with integer vs. decimal modes. For instance, either "5" or "5.0" expresses the number five. As in the case with "names," numerical data may be placed anywhere within the designated fields.

A single "K" placed anywhere within the field will cause the value to be multiplied by 1000. Two "K's" will cause the value to be multiplied by 1,000,000. This feature can also be used in conjunction with the special formats described below.

5. Special Formats

Input and Outputs

Most of the numerical values supplied by the user are time oriented. Typical examples are task duration, sortie lengths, and mean time between failure. Unless otherwise specified, the program will automatically assume that all time values are given in hours except on Forms 13 and 14 where decimals or days are assumed. The user may and probably should override this feature on any form by inserting any of the following characters anywhere within the field in question:

Character	Meaning	Examples
D	Time expressed in days	3D, 4.5D
M	Time expressed in minutes	30M
H	Time expressed in hours	4.5H, 4KH
+	Time in hours and minutes	4+00, +15
++	Time in days, hours, and minutes	3+9+15, 4+19+
W	Time expressed in weeks	2W, 2.5W
Y	Time expressed in years	1Y, 1.25Y

6. Distributions

The user may wish to express certain values, such as task durations or failure rates, as a time distribution rather than as a single time value. He may specify the use of a standard distribution directly or he may refer to an empirical distribution which he has defined.

Standard. When a standard distribution is used, the type of distribution selected is entered in the column labeled DIST. The type selected governs the statistical meaning of the data entered in the columns named MEAN and VARIANCE. The available standard distributions and their data requirements are shown in Table 3-2.

TABLE 3-2 DISTRIBUTION PARAMETERS

DISTRIBUTION	DIST	MEAN	VARIANCE
NORMAL	N	Statistical Mean[1]	Standard Deviation[1]
POISSON	P	Statistical Mean[1]	N/A
LOGNORMAL	L	Statistical Mean[1]	Standard Deviation[1]
EXPONENTIAL	X	Statistical Mean[1]	Threshold Constant[2]
BERNOLLI[3]	B	Statistical Mean[1]	N/A
CONSTANT	C	Statistical Mean[1]	N/A
ERLANG[4]	E	Statistical Mean[1]	Shape Parameter[1]
WEIBUL[5]	W	Scale Parameter	Shape Parameter[1]
TRIANGULAR[6]	T	Optimistic Value	Most Likely Value

1. MUST NOT BE ZERO

2. This is the minimum value drawn from the exponental distribution.

3. Input Module use only (with Form 20).

4. Implied threshold constant of zero, i.e., minimum value = 0.

5. Main Module use only (with Form 12 and 13).

6. For pessimistic value field see appropriate Form 12 or 20. CAUTION: The triangular distribution acts like a Beta distribution. Small amounts of skewness will cause the mean of the triangular distribution to move away from the most likely value specified. A distribution with Optimistic (O)=1, Most Likely (M)=2, and Pessimistic (P)=5 will have a mean that is more than 50% greater than the most likely value. The mean of any triangular distribution will be within ± 10% of the most likely value if the following conditions are true: Where these conditions cannot be met, use of the exponential or some other distribution is recommended.

NEGATIVE SKEWNESS	POSITIVE SKEWNESS
$O \geq M - 1.5 * (P-M)$	$P \leq M + 1.5 * (M-O)$

Empirical. Empirical distributions are referred to by placing an asterisk and the assigned distribution number in the field labeled "MEAN." Fields labeled DIST and VARIANCE are left blank. The distributions themselves are defined on a separate input form (Input Form 15 - Distributions).

D. Initialization Process

The Initialization Process consists of reading the input data, performing the necessary data edits, producing a user reference listing of the data as produced, and preparing a compressed, reformatted data input (Initialization) for the Main Module.

All the input data records (except form 20s) including the header records for each form are processed by the Input Module. The final record in the data must contain a 99 in column 2 and 3 as was the case of the specific forms.

Data is processed and printed as input with user diagnostics messages both interspersed throughout the listing and/or collectively placed at specific points in the processing. Often the user is warned of the same data error or inconsistency in more than one place in the listing, particularly those conditions causing the severest problem in completing the Initialization Process.

Specific information required on each of the forms will be found in Chapter VIII.

NOTE: It is the inherent responsibility of the user to go through the entire Input Module output and inspect all diagnostic messages. Problems should be corrected, assumptions understood and accepted or corrected, and all warnings heeded. This is particularly true when non-fatal, but still serious conditions in the data exist, and an Initialization is produced. REMEMBER - CHECK, DON'T ASSUME.

E. Sortie/Activity Generation - Scenario Flying Program

The Sortie/Activity Generator is the part of the Input Module that produces the mission, sortie, and activity requirements that drive the Main Module's simulation. This is normally referred to as the external (Exogenous) file and represents the scenario flying and processing program.

All the input data Form 20 records including its header record are input to this process. The final record in this data must contain a 99 in column 2 and 3 as was the case with Form 20. This Form 20 mission and activity information is provided as the framework from which the total external requirements are generated. Basically, the following general information is needed:

1. The total number of days of mission/activity requirements to generate.

2. The number of missions to be flown or activities to be processed on each particular day.

3. A designated take off time for each mission or start time for each activity.

4. How many and what type of aircraft are required by each particular mission and activity or what non-aircraft resources are required for a particular activity.

5. Identification of each mission, i.e., cross country, interdiction, etc., or activity, i.e., TCTO.

6. How long each mission's sorties will last (activities have no sorties).

7. Each mission's or activity's priority relative to other missions and activities.

The Input Module takes this data, edits it, produces a list of applicable diagnostics, and generates by time of day a tape of sequential mission and activity requirements to be read and acted upon by the Main Module. A listing of this output is also provided, if requested.

F. Output Products

The three specific outputs of the Input Module are (1) the Exogenous file which contains the flying programs, (2) the main module's Initialization file which contains the reformatted input data, and (3) an output listing of the input data as processed with applicable diagnostics.

Included in this listing will be the following:

1. A print-out of the selected run options (SPEC card information).

2. An expanded listing of the processed cards beginning at the top of a new page for the first card of a group of cards with the same form numbers.

3. Embedded diagnostics or warnings usually relating to the input data immediately prior to the message. Appendix B lists all the possible messages with a description of their meanings and uses.

4. Lists of diagnostics or warnings at the end of each group of forms processed.

5. If an Initialization is produced, a set of dictionaries and a listing of the control table are printed. These will be discussed below in detail in Paragraph G.

G. Specific Output Reports or Sections

1. SPEC Card Information - See Figure 9-14

All of the run specifications (SPEC card) options either selected by the user or defaulted are listed under this title. Included are any parameters or file assignments associated with the option. See Chapter VI for details of all Input module SPEC card options.

2. Report Specifications - See Figure 9-15

This report reflects the Form 10 input data processing and consists of a mirror image reprinting of the input records. Applicable diagnostic messages will be embedded within the report.

3. Resource Definitions - See Figure 9-16

This report reflects the Form 13 input data processing and consists of an expanded reprinting of the input records. Column headings are duplicates of those on Form 13. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print to the right of the page.

4. Task Resource Requirements - See Figure 9-17

The first part of this report reflects the Form 12 input data processing and consists of an expanded reprinting of the input records. Column headings are similar to those on Form 12. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print to the extreme right of the page.

The second part of this report is actually diagnostic message 140. All cases of circular substitution on any Form 12 or 12A are listed. The list includes resources that can substitute for another resource named on the same form and resources that are not on the form but can substitute for more than one resource named on the same form.

5. Task Network - Input Data - See Figure 9-18

This report reflects the Form 11 input data processing and consists of an expanded reprinting of the input record. However, the Selection Mode has been printed between the Prior Node, indicated by "NODE", and the task ID columns for ease of reading the data. Column headings are the same as those in the form with the addition of the first column "INDEX".

A control table, which is primarily a coded task network, is used by the Main Module instead of using node names. There is a direct one to one mapping of the row indices of the control table to the form 11 input records where record #1 is in row 1 of the table, record 2 in row 2, etc. The printing of the "INDEX" is an aid to the user when using the control table. The control table will be further described later in this section.

Applicable diagnostic messages will be embedded within this report. Any sequence numbers in the data records (Col 73-80) will print to the extreme right of the page.

6. Resource Clock Decrements - See Figure 9-19

This report reflects the Form 14 input data processing and consists of an expanded reprinting of the input record. Column headings are a duplicate of those on form 14. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print to the right of the page.

7. Empirical Distributions - See Figure 9-20

This report reflects the Form 15 input data processing and consists of an expanded reprinting of the input records. Column headings are a duplicate of those on Form 15 with one exception - the Form 15 Format (Col 11) prints along with the TYPE (Col 9) under the same report heading "TYPE". Applicable diagnostic messages will be embedded within or following the report. Any sequence numbers in the data records (Col 73-80) will print to the right of the page.

Subsequent to the processing of the data, the actual distribution is listed by Distribution No., the left column contains all the probabilities and the right column contains all the values (modified by the multiplier if present). This value is in decimal days.

8. Shift Policies - See Figure 9-21

This report reflects the Form 16 input data processing and consists of an expanded reprinting of the input records. Column headings are a duplicate of those on form 14 with the exception of the "Code" heading which is missing. However, the code data is printed at the extreme left of the report in its proper location. Continuation numbers (Col 6) will be printed with the code. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print to the right of the page.

9. Mission Entry Points - Configurations (Classes) - See Figure 9-22

This report reflects the Form 17 input data processing and consists of an expanded reprinting of the input records. Column headings differ from the Form 17s as follows, but the meanings are synonymous;

Form 17 Title	Report Title
Mission I.D. or Activity I.D.	MSN/ACTY I.D.
Report Column	RPT COL
Network Entry Point Node	Network Entry
Pre-Sortie External Configuration	Pre-Sortie Ext Conf
Post-Sortie External Configuration	Post-Sortie Ext Conf
Aircraft Assignment Search Pattern	Search Pattern
Aircraft Name	Aircraft Name

Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print to the right of the page.

10. Aircraft Assignment Search Patterns - See Figure 9-23

This report reflects the Form 21 input data processing and consists of an expanded reprinting of the input data records. Column headings are a duplicate of those on Form 21. The continuation card character (Col 11) prints with the Aircraft Assignment Search Pattern name in the first column. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print at the extreme right of the page.

11. Internal Equipment Authorizations/Trigger Node Changes See Figure 924

This report reflects the Form 22 input data processing and consists of an expanded reprinting of the input data records. Column headings are similar to those on Form 22. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print at the extreme right of the page.

12. Internal Equipment Group Definitions - See Figure 9-25

This report reflects the Form 23 input data processing and consists of an expanded reprinting of the input data records. Column headings are a duplicate of those on Form 23. Applicable diagnostic messages will be embedded within the report. Any sequence numbers in the data records (Col 73-80) will print at the extreme right of the page.

13. Form 20 Processing - See Figure 9-26

This report reflects the Form 20 input data processing and consists of three sections.

Section 1 will always print and consists of a mirror image reprinting of the entire input data records. As such, columns are not identified by any headings. Applicable diagnostic messages will be embedded within this part of the report.

Section 2 prints only when the second Form 20 data record containsan "L" in Column 1 or the word "LIST" in Columns 1-4. The number of days printed will be that which was requested, i.e., the number following the word "list". The headings and data printed are as follows:

Heading	Data Description
Time	Frag (Request) time for the mission or activity
Mission	Mission or activity name
Aircraft Type	Name of aircraft or non-aircraft resource entering network
Sched	Maximum # of aircraft or non-aircraft resources requested. 99 means all available (on-hand)
Min	Minimum number aircraft required for mission
Spare	Number of aircraft requested as spares
Priority	Mission or activity priority
Take-off	Scheduled take-off time or activity request time
Lateness	The interval time after the scheduled take-off time prior to cancelling the mission - in days, hours, and minutes (d+h+m)
Sortie Length	Actual sortie length in (d+h+m)
Lead Time	The interval of time prior to scheduled take-off time the frag request is made (d+h+m)

Section 3 always prints and is a summary by mission/activity type of the flying program and activity requirements generated for the period specified on the "List" card, Columns 5-7. The headings and data printed are:

Headings	Data Description
MSName	Either Mission or Activity Names
No. Missions	Actual number of missions or activities generated
No. Sorties	Actual number of sorties generated. Number shown here for activities should always equal the No. of Missions column.
Flying Hours	Total flying hours generated by mission type. Activities must always contain a zero in this column.

14. Node Usage Report - See Figure 9-28

a. Part 1

This report is a valuable aid in debugging the input data packages. The first part of the report lists all nodes in the network along with their indexes in the order in which they were referenced. The index number listed is the one at the first use of the node on the Form 11s as a prior node. Various error conditions are indicated under the CODES heading. A count of all reference to each node by form number and data field are tabularized. The headings are well defined at the beginning of the report so the report is in a compressed format.

The report is produced automatically by the Input Module. However, because of its volume, the first part of the report can be shortened by setting INFO less than 3 on the Input Module SPEC card. This will cause only the nodes with error codes to print. The various error conditions include:

Apparent Static Loop (L) - From the node referenced the loop test indicates that this same node can be reentered, i.e., a loop. This is only a warning message since this could be a valid condition if the user has some means (A, H, or F selection node, etc.) within the loop to stop the looping.

Call Section Must Not Reach a Sortie (X) - A sortie branch has been found in a network section that was called by the node referenced. Ensure that all sortie branches are in the main line network, not a called section. This is a fatal error.

Conditional Sortie (C) - The node referenced is the entry node of a network that contains a sortie task (sel mode S) that cannot be reached from the entry node 100% of the time. Verify that the network has no E branches prior to the sortie that do not sum to 100% or any A branches prior to the sortie. This is a fatal error.

Parallel Sorties (P) - The node referenced occurs either at the entry point or at some node between the entry point and the part of the network that will be able to reach parallel sorties. This a fatal error so the network must be corrected.

Reconfiguration Entry Must Not Reach a Sortie (R) - The node referenced is either an external or an internal reconfiguration entry node (specified on Form 22) that can reach a sortie task. This is illegal so ensure that no reconfiguration node has a sortie branch in its network.

Sequential Sorties (S) - The node referenced is the first sortie in a network path which includes more than one sortie. This error message will appear even if one of the sorties occurs illegally in a call section. Verify that the network has no double sortie branch in sequence (even with intermediary branches with other selection modes).

Undefined node (*) - This is a node that has references in Columns 2 thru 5 but has none in Column 1, i.e., it never appeared on a Form 11 as a prior node. This is a fatal error because it means there are real voids in the network which will result in an abort condition in the Main Module processing. Possible corrective actions include: (1) Rename the "next node" listed to match an applicable "prior node" to which it is to be linked; (2) Rename an applicable "prior node" to match the listed undefined "next node"; (3) Remove the "next node" name listed as the undefined node if the prior task is the last task in that branch of the network (no subsequent tasks link to the undefined node).

NOTE: When renaming nodes, avoid duplication of node names that will cause improper linking to other networks.

Unused Node (+) or Unreachable Node (U) - This is a node that has references only in Column 1, i.e., defined as a prior node on a Form 11 but never referenced elsewhere. This is only a warning message since no network voids exist; only extra unnecessary data is present (and may be the user's desire).

b. Part 2

The second part of the Node Usage Report lists all nodes with parallel branches. The index and the selection mode of all occurrences of the source node are listed together. This report replaces the message 62s which used to appear throughout the Task Network Report (Form 11s) wherever the same prior node appeared more than once.

15. Summary Diagnostics - See Figure 9-27

This section of the Input Module run between the Node Usage Report and Input Data Summary is not actually a report but a collection of summary diagnostic messages indicating problems or lack of problems in the data input. Messages that will be found here are, but not limited to, the following message numbers; 24, 36, 11, 79, 80, 96, 97, 117, 31, etc. When error conditions exist, additional messages will be found at this output location.

16. Input Data Summary - See Figure 9-29

This section/report contains a summary of the size of the input data. Sources of the values in this summary are as follows:

Information *	Source
Resources	No. of Resources Defined on Form 13.
Task Names	No. of Tasks Defined on Form 12.
Node Names	No. of Nodes Defined on Form 11.
Control Table Entries	No. of Form 11 data records.
Failure Clocks	No. of Clocks Defined on Form 13.
Mission Entry Points (IETB)	No. of Different Entry Nodes used on Form 17.
Resources Entering Network (NACO)	No. of A/C defined, + Resources marked in Col 11 on Form 13, +1.
Total # of Configurations Defined (All A/C) (NCRS)	Total # of different configurations defined on the Form 17s.
Search Patterns (NSRPT)	No. of Configuration Management List names defined on Form 21.

Next Higher Failures (NNHF)	Indicator of F tasks stringing. This no. divided by no. clocks is the average depth of the F string.
Task Resource Requirements (TRR)	No. of different (TRR) entries on Form 12, i.e., cols 37-63. Duplicates are removed.
Unique Groups of Clock Decrements (NOCL)	No. of different groups of clocks decremented by constant values on Form 14.
Unique pieces of Int. Equip. (EQUIP)	No. of different int. equip. defined on Form 22.
Internal Equip. Groups (ILIST)	No. of Int Equip Groups defined on Form 23.
Triggering Events (NTEVT.DV)	No. of trigger nodes defined on Form 22 is.
Operations Headings on Form 10	No. of entries on Form 10, subtype 03, plus 1.
Aircraft Headings on Form 10	No. of entries on Form 10, subtype 05, plus 1.
Personnel Headings on Form 10	No. of entries on Form 10, subtype 07, plus 1.
Part Headings on Form 10	No. of entries on Form 10, subtype 09, plus 1.
AGE Headings on Form 10	No. of entries on Form 10, subtype 11, plus 1.

*Footnote: Information in parenthesis is programmer oriented.

This summary is an indicator of not only the size of the input data, but also its general overall structure. By analyzing the relationship of the values, for example, the ratio between the "Next high failures" and the "Failure Clocks" the average depth of F task stringing can be determined. A large ratio indicates clocks are being used at a lower or subsystem level. Other similar observations can be made.

By using these numbers and other information from the input data as input to the Core Estimator (see Appendix B), a user can approximate the initial Main Module core requirements.

17. Dictionaries

The remainder of the Input Module reports are termed "Dictionaries." These are the user's primary interface with the Main Module. The dictionaries are required since the names assigned by the user to tasks, resources, missions, etc., are primarily for the user's benefit and are not carried into the Main Module. This is due to the excessive amount of memory required to store them. They are, in fact, used by the Main Module but only in terms of a number within a sequenced list of names--hence, the dictionaries. These are very useful to the analyst in the detailed evaluation of the Main Module simulation runs.

All the dictionaries will print only when the Input Module data is clean of all fatal error messages, therefore, if they are printed, an Initialization is to be produced. A description of all dictionaries follows.

18. Resource - Dictionary - See Figure 9-30

This dictionary titled "Resources" prints after the Input Data Summary. It not only contains the assigned numbers of the resources, as referenced in the Main Module, but includes additional usage information. The maximum authorizations (MXAUTH) established in the input data (on Form 13 or Form 16) is specified here along with the maximum single usage (MXUSE) of that resource on a task (Form 12). Where the MXUSE exceeds the MXAUTH, a Flag (+) is given. Users running a main simulation run without correcting this situation can expect the run to bottleneck on the resources so flagged. AUTH and SAUTH change cards in the Main Module run will correct this situation. The order of assignment of the resource ID #'s is normally the order the resources appear in on the Form 13's. However, they are in the order of appearance on the Form 12's if the 12's are entered before the 13's.

The exact definitions of the columns following the resource name are:

MXAUTH	Authorized quantity established on Form 13, Columns 24-27, or forresources on a shift, the maximum shift authorization on Form 16, Columns 14-69.
MXUSE	The maximum task resource requirement quantity specified on Form 12 or 12A in Columns 44-45, 53-54, or 62-63.
FLAG	Will print out as a "+" sign if the MXUSE is greater than MXAUTH.

19. Failure Clocks - Dictionary - See Figure 9-31

This dictionary lists the failure clock names defined on Form 13 with the assigned reference number that is used by the Main Module.

20. Tasks - Dictionary - See Figure 9-32

This dictionary lists the tasks defined on Form 12 with the assigned reference number that is used by the Main Module.

21. Task Resource Requirements - Duplicates are Merged - See Figure 9-33A

This data is primarily a dictionary (without assigned numbers) of the Task Resource Requirements (TRR) table. Duplicate TRR requirements (Col 30-35 and 37-63 on Form 12) have been eliminated from this table resulting in a substantial savings of memory in the Main Module's simulation run. The number of Duplicate TRR requirements is indicated by the "Usage Count." The table is structured as sets of 3 entries across the page, a set for each resource required. An interpretation of each entry is as follows:

Resource	Name of Resource
QTY	(1) Positive number is quantity from Col 44-45, 53-54, or 62-63. (2) Negative number is quantity from Col 44-45, 53-54, or 62-63 as before, but has been set negative to indicate a C for "consume" has appeared in the associated Col 43, 52, or 61. (3) If QTY = 99999, there was a * in Col 29 and the resource field is from Col 30-35.
Sub Flag	If an X appears, it means an X was placed in the "C" field (Col 43, 52, or 61) to activate generalized substitution.

22. Resource Combination Sets - See Figure 9-33B

This dictionary is a further breakdown of the Task Resource Requirements described above, but it includes only those groups of resources described on a Form 12A with a specific Resource Combination Set name (Cols 30-35).

23. External Configurations (Classes) - See Figure 9-34

This dictionary lists, by aircraft type, the individual external configurations (classes) and the assigned reference index number that is used by the Main Module. Also indicated is the frequency that each class is searched by the Aircraft Assignment Search Patterns. Message 53 always prints as a warning.

24. Aircraft Assignment Search Patterns - See Figure 9-35

This dictionary lists the following:

Title	Description
Index	Assigned Main Module reference number.
Name	Aircraft Assignment Search Pattern Name.
Aircraft	Particular aircraft using this search pattern.
No. of Refs	No. of Form 17 missions or activities using the search patterns.
No. of Classes Searched	Self-explanatory (i.e., depth of search)

25. Internal Equipment By Aircraft - See Figure 9-36

This dictionary lists by aircraft type, the internal equipment name defined on Form 22, its assigned Main Module reference index, and the frequency of its reference on Form 23.

26. Internal Equipment Groups - See Figure 9-37

This dictionary lists the following:

Title	Description
Index	Assigned Main Module reference number
Name	Internal equipment names from Form 23
Aircraft	Particular aircraft type using this group
No. of Refs	Number of Form 21 references to this group
No. of Equipment Referenced	Number of internal equipment names referenced by this group on Form 23.

27. Control Table - See Figure 9-38

This dictionary is the most important for the user to understand. It is a convenient way to pass the network to the Main Module's simulation process and when thoroughly understood, is an exceptionally good debugging tool. It is merely a tabularization of the Form 11 network. In fact, Row index #1 is the first Form 11 record; Row 2, the second Form 11 record, ... etc. Sequence numbers indices have been added in front of the Form 11 Network processing records for ease of reference back and forth between the input network data and this control table. The information provided is as follows:

Heading Title	Description
Index	Assigned Main Module reference number (actual Form 11 input record sequential number).
Task	Task name; or a "$" if selection mode is C.
TTID	Task ID number (from task dictionary); or control table index containing the called node, if selection mode is C.
C	Tasks that decrement clocks - indicated by a minus sign.
Sel	Input selection mode.
PAR	Selection Parameter for modes A, E, F, G, and H.
NIND	Control table index containing the next branch in the network.
NAIND	Control table index containing the first branch of the network in parallel with current index.

28. Initialization Data - See Figure 9-39

This data beginning with the number 200004 displays programmer type encoded data contained in the Initialization that is produced. It will be printed when the SPEC card option INFO=4 and would only be required when debugging LCOM problems. The quantity of print generated is quite large.

29. Other Text Messages

Message	Description
Main Module Init File is to be produced	Located just after Control Table and is self-explanatory.
Main Module Init File suppressed due to errors	Located after Input Data Summary and is self-explanatory.
Legitimate End Marker Written	Located just after the "Main Module File is to be produced" message if the complete Initialization file has been written. This message must be present before continuing on to the Main Module runs.
Legitimate End Marker Read	Located just after the Initialization Data Printout when requested by SPEC option INFO=4. Indicates that the Initialization File was completely read and printed.
XXXX words unused	If present, will be located on the last page of OUTPUT. It is an indication of over-assignment of memory for the Run. Reduce the core assigned by this value for optimum computer core utilization.
XXXX Extra Pages Acquired	If present, will be located on the last page of OUTPUT. It is an indication of under-assignment of memory for the Run. Increase the core assigned by this value (times 1024) for optimum computer core utilization.

IV. MAIN MODULE

A. General Description

1. Overview

The main module of the LCOM II Simulation Software is designed to simulate a broad range of aircraft operations, scheduling, maintenance, and supply functions at an Air Force base. In accordance with the LCOM II design objectives, the logical ordering of actions within the simulation may be adapted to many problem situations and therefore must be specified by the user for his specific application. The user is free to define both the resources of interest and the manner of their intended utilization, while the software provides the necessary controls and structure to simulate and maintain a record of their action and interaction.

Although LCOM II Simulation Software specifically addresses an AF base, the techniques used permit the potential application of the software to the depot structure both in terms of its relationship to the base or specifically the depot itself.

2. Simulation Process

Using the Initialization and Exogenous file produced by the Input Module, the simulation process is undertaken for some desired period of time. The maintenance requirements are generated during the simulation by combining the simulated flying of aircraft (Exogenous) and the inputted failure rates as guided by the input maintenance data (Initialization), the resources are demanded and utilized, aircraft are serviced, inspected if necessary, and returned to serviceable condition to fly again. During the simulation, reports are produced showing the operational effectiveness, spares requirements, stock level performance, and a variety of resource utilization and performance data. Since not all reports and their associated trend analysis can be accomplished during the simulation process transaction, typed data is collected and stored on a file for subsequent processing by a set of post processor programs. Reports from these post processors aid in the total simulation analysis.

3. Data Requirements

There are three distinct functional areas at an Air Force base; that of operations, maintenance, and supply. These areas, without fully considering the effects of the others, will always leave something to be desired.

No existing simulation model has been able to completely address this overlap in-depth within a single model. There are many models which address a specific area in depth but sacrifice the total effects of the other areas by abstracting them to some degree. LCOM II Simulation Software has been designed to adequately address this overlap by permitting the information and logic of each specific area to be user described in terms of some data base. This data represents the environment at the specific base, wing or squadron, whichever is being simulated.

The explicit purpose of the simulation software is to provide a capability to represent the demand processes and reflect the interaction of support resources availability, i.e., aircraft, men, parts, and equipment, both on flight line and in shops. In order to accomplish this, the software requires user provided logic in the form of a network of information. This "task network representation" is the key LCOM II feature which permits the user to describe the maintenance environment to whatever depth desired in terms of a sequence of tasks required on the aircraft or any of its recoverable parts.

The LCOM II Simulation Software utilizes three basic data sources:

a. Operations data, which includes the number of missions, mission type ,time of take-off, sortie duration, number of aircraft required, and other related mission data. Included in this data are the activities, user defined external requirements for either aircraft or non-aircraft resources which are to be processed in such a manner that does not lead to or involve a sortie task.

b. Maintenance data, which is primarily AFM 66-1 data, in the form of a maintenance network, the structure of which will be described later. This data includes necessary scheduled maintenance actions required on both aircraft and non-aircraft resources.

c. Supply data, which includes the supply, demand, and resupply processes at the various levels of part indentures, i.e., assembly, sub-assembly, sub-sub-assembly, module, etc., according to the user definition. Generally Work Unit Code references are used.

4. Information Structure - See Figure 4-1

The main module expects the user environment to be described in three basic network segments; pre-sortie, sortie, and post-sortie. Additional optional segments are the external and internal reconfiguration networks. These segments will be described in-depth in the feature descriptions portion of this chapter. The relationship of these segments are reflected in Figure 4-1. The segment called sortie is in reality only one task, the sortie task. However, frequently in parallel to this task are the clock decrement tasks (to be described later).

The size and complexity of the rest of these segments are entirely controlled by the user. The following discussion indicates the depth to which these network segments can and often are defined by the user.

During the course of the simulation, various types of missions and activities are scheduled based upon operations data provided by the user. For each mission requirement, the main module controls the processing of each aircraft thru the pre-sortie networks towards the completion of the mission (the sortie(s)) then through any user defined maintenance which may result from the mission. This is illustrated in Figure 4-1. As in real life, the main module attempts to complete all missions, but some cannot be completed as scheduled.

After the mission is completed, the aircraft will process thru the user defined post-sortie tasks. These tasks would normally include debriefing and troubleshooting tasks in which aircraft system failures are detected and their correction begun. This phase of the simulation would be where the user specifies the demands for spares from supply, and simultaneously generates reparable assemblies for maintenance in the base repair shops, or in the case of NRTS (Not Reparable This Station) items, the depot-level repair facilities.

Maintenance at this point could follow two distinct paths: one for the aircraft itself (flightline maintenance) and one for the reparable assemblies (shop maintenance).

Flightline maintenance normally consists of those tasks required to troubleshoot and remedy failures either on the aircraft or by replacement of faulty items with serviceable spares. After all aircraft maintenance is completed, the aircraft is returned to a serviceable pool, or if the maintenance was required during pre-sortie processing leading to a mission which is still valid (scheduled), the aircraft continues processing its pre-sortie tasks.

Shop maintenance tasks are those base or depot tasks required to troubleshoot the reparable assembly and remedy the failure by repair and/or replacement of one or more of its first indenture assemblies, followed by some functional test. Following the replacement, a second indenture reparable may be generated for further base or depot maintenance. This method of sub-indenture failure generation can be repeated down to any level and is dependent only upon the data availability and computer capacity. For each indenture, maintenance is accomplished in the same manner as described above. Individual reparable items follow either their own maintenance tasks as described by the input, or a general abstracted set of maintenance tasks, as might be the case at the lowest indentures studied.

Whether to repair an item at base or depot is a selection based upon the input NRTS (to depot) percentage for that item. In each case, the reparable follows a specific set of tasks. For the depot, this set of tasks can be described as a single task representing the depot order and shipping time. Upon completion of the designated tasks at either base or depot, the unit is returned to base supply as a serviceable item and appropriate stock levels are incremented.

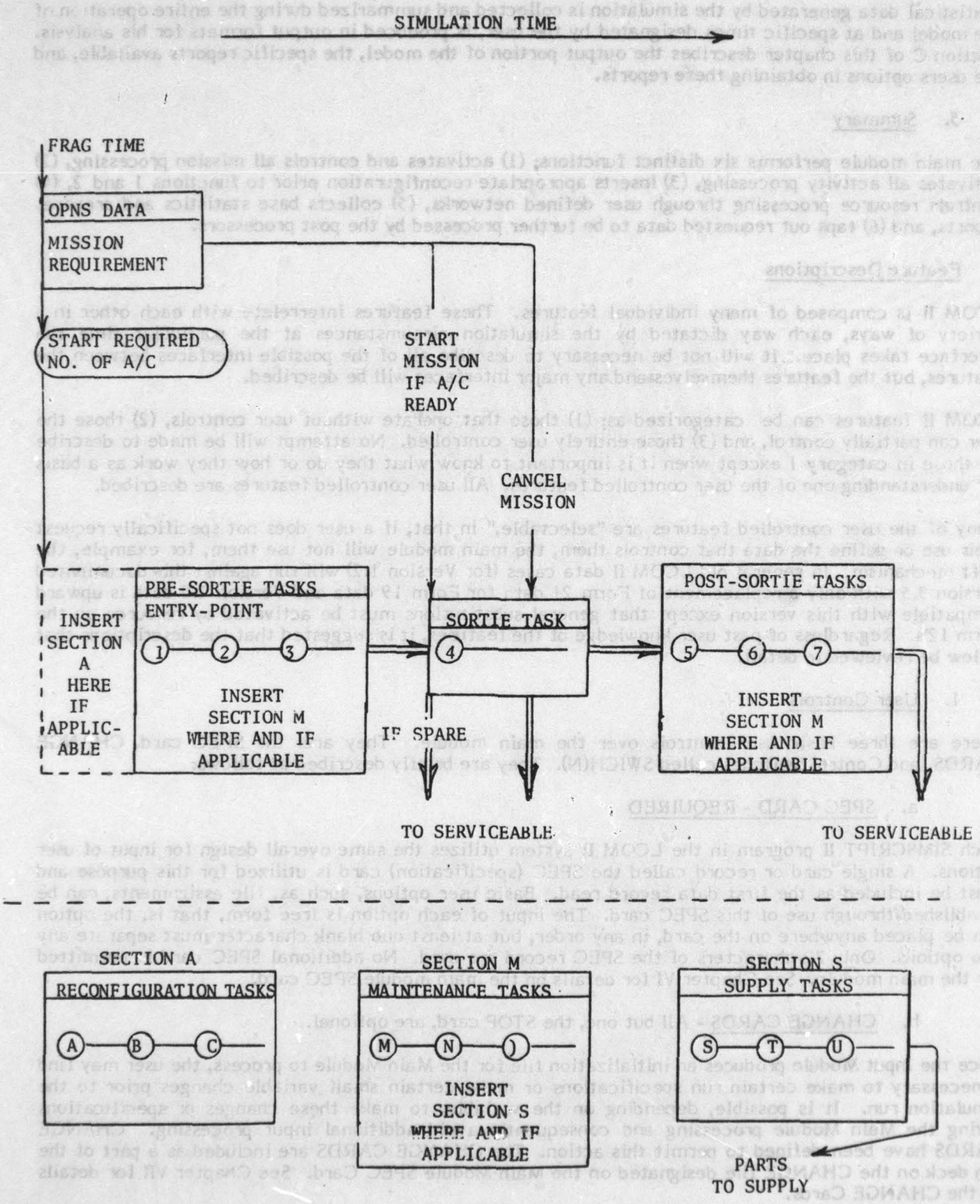


FIGURE 4-1 OVERALL BASIC MODEL NETWORK AND TIMING LOGIC

Statistical data generated by the simulation is collected and summarized during the entire operation of the model and at specific times designated by the user, is produced in output formats for his analysis. Section C of this chapter describes the output portion of the model, the specific reports available, and the users options in obtaining these reports.

5. Summary

The main module performs six distinct functions; (1) activates and controls all mission processing, (2) activates all activity processing, (3) inserts appropriate reconfiguration prior to functions 1 and 2, (4) controls resource processing through user defined networks, (5) collects base statistics and prepares reports, and (6) taps out requested data to be further processed by the post processors.

B. Feature Descriptions

LCOM II is composed of many individual features. These features interrelate with each other in a variety of ways, each way dictated by the simulation circumstances at the particular time the interface takes place. It will not be necessary to describe all of the possible interfaces between the features, but the features themselves and any major interfaces will be described.

LCOM II features can be categorized as; (1) those that operate without user controls, (2) those the user can partially control, and (3) those entirely user controlled. No attempt will be made to describe all those in category 1 except when it is important to know what they do or how they work as a basis for understanding one of the user controlled features. All user controlled features are described.

Many of the user controlled features are "selectable," in that, if a user does not specifically request their use or define the data that controls them, the main module will not use them, for example, the shift mechanism. In general old LCOM II data cases (for Version 1.2) will run against this documented Version 3.5 with only a replacement of Form 21 data for Form 19 data and Version 2.0 data is upward compatible with this version except that general substitutions must be activated by resource on the Form 12's. Regardless of past user knowledge of the features, it is suggested that the descriptions that follow be reviewed in detail.

1. User Controls

There are three basic user controls over the main module. They are: the SPEC card, CHANGE CARDS, and Control Switches called SWICH(N). They are briefly described as follows:

a. SPEC CARD - REQUIRED

Each SIMSCRIPT II program in the LCOM II system utilizes the same overall design for input of user options. A single card or record called the SPEC (specification) card is utilized for this purpose and must be included as the first data record read. Basic user options, such as, file assignments, can be established through use of this SPEC card. The input of each option is free form, that is, the option can be placed anywhere on the card, in any order, but at least one blank character must separate any two options. Only 72 characters of the SPEC record are used. No additional SPEC card is permitted for the main module. See Chapter VI for details on the main module SPEC card.

b. CHANGE CARDS - All but one, the STOP card, are optional.

Once the Input Module produces an initialization file for the Main Module to process, the user may find it necessary to make certain run specifications or make certain small variable changes prior to the simulation run. It is possible, depending on the variable, to make these changes or specifications during the Main Module processing and consequently avoid additional input processing. CHANGE CARDS have been defined to permit this action. The CHANGE CARDS are included as a part of the run deck on the CHANGE file designated on the Main Module SPEC Card. See Chapter VII for details on the CHANGE Cards.

c. SWICH CONTROLS - Optional

An important CHANGE card is the one called SWICH. It controls 15 different switches in the main module. Each of these switches has a specific user function to perform. In addition, this feature also permits a set of callable diagnostics to remain within the debug version of the main module to assist in any program debug and in future program development. Only switches 4 and 5 are set on automatically by the input module. All others are off at the start of the run. Normally, the switches are bimodal where "0" is off and "1" is on. Some switches permit additional values greater than 1. See Chapter VII and Table 7-1 for details.

2. Processing Requirements - Missions and Activities

The Main Module is designed to respond primarily to a scheduled workload of aircraft and non-aircraft processing requirements as generated by the input data. This response is done in the following manner:

a. Missions and Sorties

Missions are those aircraft requirements that process portions of a network of tasks that lead to and include a sortie task. Aircraft sorties have a direct and unseverable relationship with missions. Missions are scheduled and consist of one or more sorties, each representing one aircraft. Different types of aircraft may be related to different missions as defined on Input Form 17, but must be requested on Form 20 by take-off time. Specifics about defining and requesting missions are described in Chapter VIII. Figure 4-1 is applicable to much of this section so further references to it have been omitted.

The mission is placed on the schedule (exogenous file by the input module) at take-off time minus the lead time specified for the processing of pre-sortie tasks. The number of sorties required for the mission is determined and the mission ownership of the member sorties is established. The number of sorties scheduled is equal to the maximum aircraft identified on input form 20. An equal number of aircraft are requested for the mission plus any spares designated.

The pre-sortie set of tasks is started for each sortie by first obtaining a properly configured aircraft from the on-hand balance of those available. If other than the requested configuration is obtained, the proper section of reconfiguration tasks is added in front of and processed prior to the pre-sortie tasks. A more detailed description of the aircraft configuration feature is described within this section under the title of Configuration Management. If an aircraft cannot be found, the demand is backordered until satisfied. Once satisfied, the processing of the pre-sortie task and any applicable reconfiguration tasks are begun.

As each aircraft assigned to the mission completes its pre-sortie tasks, the aircraft is flagged ready to go on the mission. When the scheduled take off time for the mission arrives, the number of ready aircraft are checked and if enough are ready, the mission goes, i.e., each aircraft (up to the maximum requested) begins its sortie task., spares are released as serviceable aircraft and/or any not ready aircraft are flagged as late for the mission but continue to process towards the sortie task for subsequent release as a serviceable aircraft. If insufficient aircraft are available, the mission is delayed until: (1) sufficient aircraft become ready or (2) the time to cancel the mission arrives, whichever occurs first.

If the time to cancel the mission occurs first, a final check is made to see if there are sufficient aircraft to "replace" up to the minimum those currently assigned but not ready to fly in order to accomplish the mission. Replacement aircraft are those aircraft in the correct configuration and ready to fly condition. If there are sufficient replacement aircraft they are assigned (plugged into the mission) and the mission will be accomplished. Otherwise; (1) the entire mission is scrubbed, (2) all ready aircraft are released as serviceable aircraft, (3) any pre-sortie processing aircraft are flagged as late for their mission but continue processing towards the sortie task for subsequent release as a serviceable aircraft, and (4) any outstanding requests for aircraft for the mission are cancelled.

Once the sortie task is completed, the aircraft begins its set of post-sortie tasks. When these are complete, the aircraft is released to the simulation as a serviceable aircraft for subsequent reassignment.

b. Activities

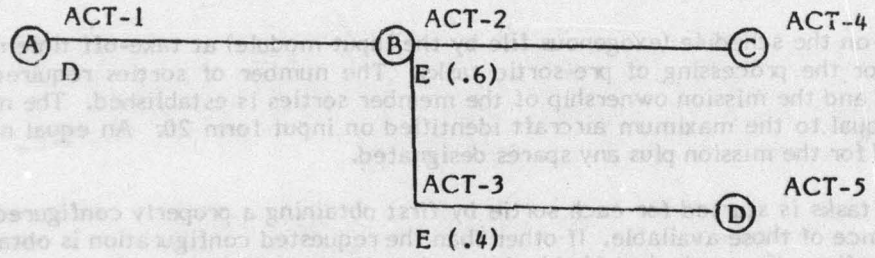
Activities are those processing requirements that process portions of a network of tasks. However, these networks must not contain a sortie task. They can be processed by either an aircraft or non-aircraft resource. Normally, this type of processing will be actions such as; snow removal from runways, special aircraft ground processing, test equipment modification, time compliance technical orders (TCTOs), etc.

Activities are defined on Form 17 and must be requested on Form 20 by requested time of activity start-up. Specifics about defining and requesting activities is described in Chapter VIII, and in the Chapter IV feature description Time Controlled Activity Processing.

3. Network Description

a. Terms

The support environment for any LCOM II simulation is described for the model in terms of a network of tasks. A task is defined as a requirement for resources, men, parts, equipment, and time; and has a defined relationship with other tasks in terms of either successor, series, or parallel tasks. Figure 4-2 contains the basic network terms and their definitions. This network is defined on Form 11. Chapter VIII describes the specifics for defining the networks.



Terms	Definition
NETWORK	- A logical flow of actions represented by the above diagram.
NODE	- Action connectors such as A,B,C, and D above.
BRANCH	- Emanating from Node B are two parallel paths or branches. Any number of branches are permitted.
TASK	- Action names such as ACT-1, ACT-2,....ACT-5 which are accomplished on a particular branch.
SELECTION MODE	- The procedure whereby a user defines the network path selection. Examples are the D represents "DO" the task specified, and the E means "Either" do ACT-2 or ACT-3. Fifteen different single character user defined modes are acceptable.
SELECTION PARAMETER	- The .6 means 60% of the time ACT-2 is done; .4 means 40% of the time ACT-3 is done. Several of the acceptable selection modes have parameters.

FIGURE 4-2. NETWORK TERMS DEFINITIONS

b. Example Networks

The simplest mission network contains three tasks; a pre-sortie, sortie and post-sortie task, while the simplest activity network contains only one task. Figure 4-3 illustrates an example of a simplified task network for a mission.

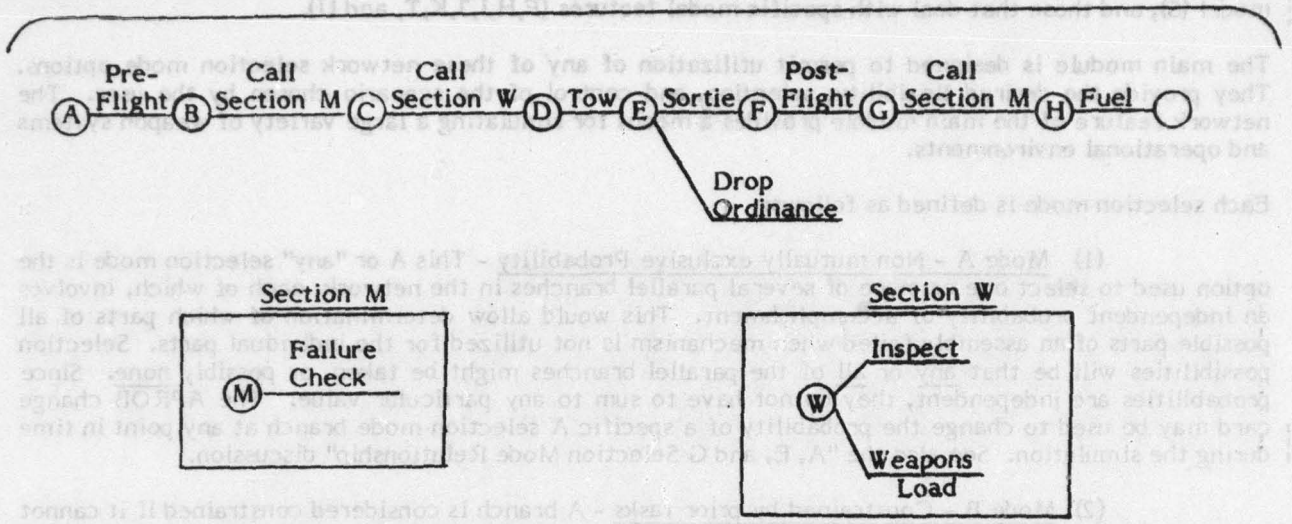


FIGURE 4-3. SIMPLIFIED MISSION TASK NETWORK EXAMPLE

In Figure 4-3, the sortie task is the series successor to the tow task and the drop ordinance is a parallel task to the sortie task. The description of any network of tasks is flexible in that it can be described by the user to any degree of simplicity or complexity desired. One feature permits the network to be designed in sections, thereby reducing the complexity and size of the network input data. A separate section which is utilized in more than one place in the total network, as Section M was in Figure 4-3, can thus be defined only once and called from several locations within the network. In the example, this might be a maintenance action or actions possible in both pre- and post-sortie periods of time. The size of these sections is not limited.

Another use of sectioning is based upon the fact that once called, all actions within the section must be complete prior to continuing processing of the network from which the call was made. In Figure 4-3, Section W has two tasks in parallel, Inspect and Weapons Load. Both of these tasks must be completed prior to returning to the main network and doing the tow task.

c. Network Entry

During the simulation, task network processing is started by defining an entry point to the network and mission type that will trigger this initial entry. In Figure 4-3, Node A is this entry. Each entry generates an explicit network identifier which has associated with it an aircraft or part resource that is controlled by the network until its processing is completed and the associated part is released. The network identification is established to permit a series of tasks to generate new series of tasks involving different resources without losing the relationship to the generating network. This is exemplified by repair of an aircraft generating a reparable to the shop, the repair of the reparable generating repair of a sub-assembly, etc.

d. Selection Modes

The processing of each task in the network is determined by a selection mode defined in the input data which may specify one of 15 options. These options include modes A,B,C,D,E,F,G,H,I,J,K,R,S,T, and U. These modes can be basically sub-divided into: those that are discrete functions (B,C,D, and R), those that are probabilistic in nature (A,E, and G), those used to control mission timing within the model (S), and those that deal with specific model features (F,H,I,J,K,T, and U).

The main module is designed to permit utilization of any of these network selection mode options. They provide the desired flexibility, selection, and control of the scenario chosen by the user. The network feature of the main module provides a means for simulating a large variety of weapon systems and operational environments.

Each selection mode is defined as follows:

(1) Mode A - Non mutually exclusive Probability - This A or "any" selection mode is the option used to select one or more of several parallel branches in the network, each of which, involves an independent probability of accomplishment. This would allow determination of which parts of all possible parts of an assembly failed when mechanism is not utilized for the individual parts. Selection possibilities will be that any or all of the parallel branches might be taken, or possibly none. Since probabilities are independent, they do not have to sum to any particular value. The APROB change card may be used to change the probability of a specific A selection mode branch at any point in time during the simulation. See also the "A, E, and G Selection Mode Relationship" discussion.

(2) Mode B - Constrained by prior tasks - A branch is considered constrained if it cannot be started until a number of preceding tasks have been completed. The preceding tasks would normally be indicated as parallel tasks, each of which leads to the task in question. This selection option on a task indicates that all tasks leading directly to it must be completed before an attempt is made to start it. Failure to use this option would allow the constrained task to be started as often as there are tasks leading to it, so, it is necessary to use this selection mode whenever more than one task, all of which will be done, lead to the same task. The tow task in Figure 4-3 is an example of this type of task and if the tasks in Section W (Inspect and Weapons Load) were in the main network instead of the call section the tow task would have been input as mode B. Caution: Where there exists a possibility of another task being parallel to this constrained task processing may not continue through it. Therefore, the definition of the constraining and constrained task, should be made within a small network section to preclude this possibility. As an example of this, on Figure 4-3, the constrained tow task and the inspect and weapons load tasks would be input as a separate section. Please note that if the call section W contains only the Inspect and Weapons Load task processing would also be proper, since the entire call section itself must be complete prior to continuing in the main network. Hence, a call section most often does the same thing as a B mode and is the preferred way of handling constraining situations. If B mode is used, do it within a call section and be careful.

(3) Mode C - Network Section Selection - This C or "call" option permits the user to describe the task network in sections to eliminate duplication of network data and call the section from any place in the networks. An example of a section is shown in Figure 4-4.

In Figure 4-3, Section M is a network of maintenance tasks common to two points in the general network. Upon completion of the pre-flight, Section M is called and upon completion of all tasks in Section M, return is made to the Call Section W task of the general network. A similar action is performed after post-flight. This is a powerful and effective tool for network simplification and controlled network processing. Figure 4-5 is a partially expanded view of Section M and figure 4-4.

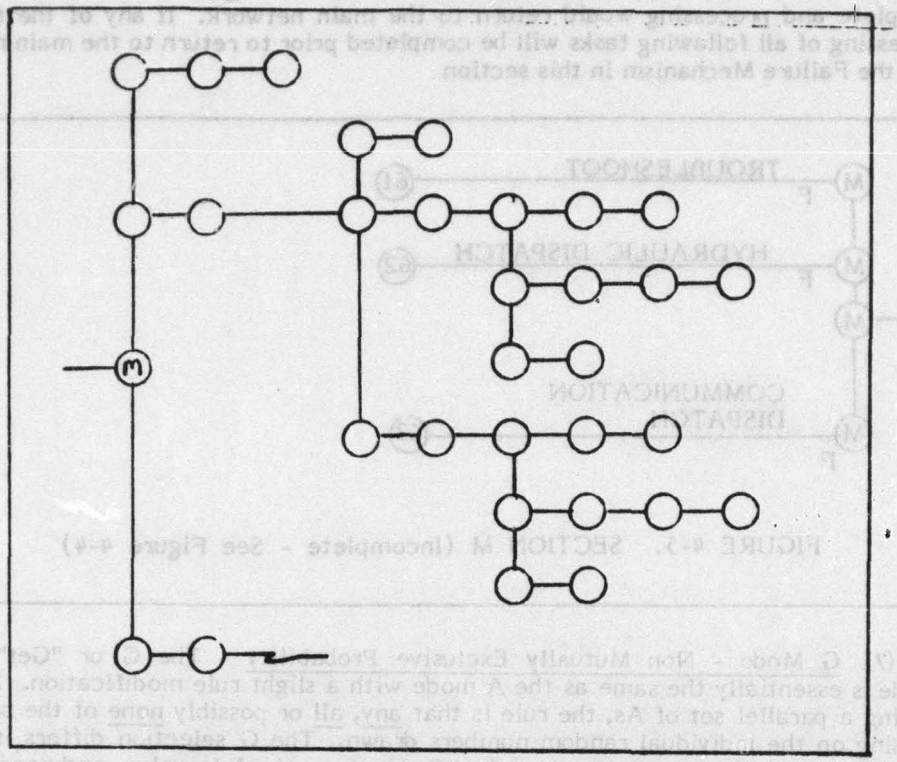


FIGURE 4-4. EXAMPLE OF A SECTION

(4) Mode D - "Do" the task - This option is used when there is no question of selection. When this mode is used, it means no criterion is required to select whether or not the task is done. It is always done when it is addressed by a preceding task.

(5) Mode E - Mutually Exclusive Probability - This E or "Either" selection mode is the option used to select only one of several possible parallel tasks in the network. This option allows a selection such as base or depot repair, utilizing the NRTS percent to make the selection. Since the probability values are mutually exclusive, all possibilities should be accounted for and the sum of the probability values from the same node must sum to exactly 1.0 or less. When one branching possibility is to do nothing, it can be eliminated i.e. the sum would be less than 1.0. A restriction when using this mode is to not mix two sets of E branches emanating from the same node. The EPROB change card may be used to change the probability of a specific E selection node branch at any point in time during the simulation. See also the "A, E, and G Selection Mode Relationship" description.

(6) F Mode - Failure Mode Selection - This F or "Failure" option indicates that task accomplishment will be determined by a failure clock associated with some resource farther along in the network. During troubleshooting in real life, a particular check or task will give an indication of whether an assembly is serviceable or not and will indicate whether to proceed with further checks on the unit. This failure selection option indicates to the main module that the task in question is of that type, i.e., it will be done if it leads to the discovery of a failure. If there is no failure of a resource along this path, then the tasks with this selection option leading to the potential failure task will not be done. Thus, it is the failure mechanism which determines if a task is to be selected, and it is this selection option which determines which tasks are involved and subject to selection. At least the first

tasks in Section M would have this option. They would not be done unless there is a malfunction of some type further on in the network. If none of the three tasks in Figure 4-5 were selected, the section would be complete and processing would return to the main network. If any of the three tasks are selected, processing of all following tasks will be completed prior to return to the main network. See a description of the Failure Mechanism in this section

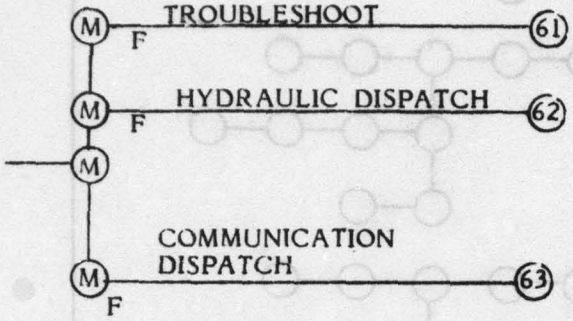


FIGURE 4-5. SECTION M (Incomplete - See Figure 4-4)

(7) G Mode - Non Mutually Exclusive Probability - The G or "Get" at least one, Selection Mode is essentially the same as the A mode with a slight rule modification. Remember that when processing a parallel set of As, the rule is that any, all or possibly none of the branches may be taken, depending on the individual random numbers drawn. The G selection differs in two respects. First, if these same A tasks were instead marked G, given an absolute value, and none were selected, then the model would recycle (take another set of random draws) until at least one G task was chosen. Secondly, as will be demonstrated in the portion of this section titled "A, E, and G Selection Mode Relationships", the G selection mode is statistically different than A when considering the independence of failures. In addition, use of the G mode will definitely increase simulation run time particularly if small G selection parameters are used. The only restriction on use of the G mode is that if it is used at a particular juncture/node, then all tasks emanating from that juncture must also be G selection modes. The GPROB change card may be used to change the probability branch at any point in time during the simulation. Refer also to AFMSMET Report 78-2, "The G Selection Mode Its Independent and Dependent Use."

(8) H Mode - Halt Mechanism Controlled - The H or "Halt" mode acts like the F mode except in the reverse. Recall that if a failure clock has breached for a particular F task, that task will be done. If a HALT clock has breached for a particular H task, the processing of that particular task and the subsequent network tasks will Halt at that point. Consider the H as a failure generated stopping point in the particular leg of the network being processed. See description of the Halt mechanism in this section for details.

(9) I Mode - Cannibalization Data Mode - The I or "Ignore" selection mode is used in conjunction with the cannibalization mechanism. It is used only on tasks that consume a part and indicate to the cannibalization mechanism that the part being consumed should be included in the list of cannibalized parts. It also tells the normal processing to ignore the task time when the part is received from supply. See Cannibalization Mechanism Description in this section for detail of use.

(10) J MODE - Aircraft Timing Switch - The J or "Jump" selection mode is used to partially activate the "Aircraft K Timing Switch" which in turn controls the processing of the J and K selection mode tasks. See Selection mode K and U, and the Aircraft K-Timing Switch descriptions in this section.

(11) K MODE - Aircraft Time Switch - The K or "Kill" selection mode is used to fully activate the "Aircraft K Timing Switch" which in turn controls the processing of the J and K selection mode tasks. See Selection mode J and U, and the Aircraft K-Timing Switch descriptions in this section.

(12) R MODE - Resource Availability Mode - The R or "Resource" mode permits the placing of tasks on parallel network branches originating at a common node and, based upon resource availability, having only one of the tasks process. This is accomplished by defining R as the selection mode for these branches. The R mode functions very much like the G mode, but very important differences exist.

The G mode checks a percent parameter to determine which parallel task or tasks will be accomplished. The R mode sequentially checks each parallel branch for the availability of all the resources required by the individual tasks. If the resources are available, only that task is started. No other parallel tasks will start.

The G mode will make sufficient passes through the parallel tasks until at least one is started. The R mode will make one pass. If none can be started, the first task will be backordered. Note again that only one of the parallel tasks will be started, therefore, once the backordering takes place, only this backordered task (the first of the series) will be considered for further processing.

The user must define only R selection modes in parallel or R modes mixed with D modes. Any other combination is illegal and will cause a fatal error message to be printed by the Input Module.

The parallel R selection modes must not be placed directly in the main line network such that each branch leads to a sortie task. This will cause an error message from the Input Module network search. This R mode option should only be used within a call section, post-sortie, or activity processing network.

(13) S Mode - Sortie Task Timing Control - This S or "Sortie" option is assigned to the sortie task, a task whose starting time is to be controlled by the mission data. When this option is encountered on a task, mission data is referenced in order to establish the earliest possible starting time. If the preceding task is completed and other mission requirements are satisfied, the task will be started.

(14) T Mode - Trigger Node Controlled - This T or "Trigger" selection mode is used for the Configuration Management of Internal Equipment on an aircraft. It is treated as a do task for network processing purposes but will trigger either the loss or gain of some internal piece of equipment. See Configuration Management - Internal Configuration Mechanism description in this section. Note: When dealing with parallel branches, only 1 T can be used and it must occur first in the Form 11's.

(15) U Mode - Aircraft Timing Switch - The U or "Unschedule and Unset" mode is used to deactivate the "Aircraft Timing Switch" after it has been turned fully on and a reset for it has been scheduled. See Selection mode J and K and the Aircraft Timing Switch descriptions in this section.

4. Control Table/Network Relationship

The Control Table used by the main simulation model is just a tabularization of the input network on Form 11. It differs from the input data by using a different structure and numeric codes rather than alphabetic names and codes. To an LCOM II user, the terms "Network" and "Control Table" should be synonymous. Their exact data relationship is described in the Chapter III description of Control Table output.

5. Task Description

Each task used in the network is individually defined as a job with requirements for time and resources. The same task may be used in several places in the complete network, but will require only one description. All the tasks are collected by the Input Module into a set called the task dictionary.

The type of task specified controls the collection of processing statistics into the proper categories of work. The input priority controls the initial task's priority assignments. See Priority System feature description.

The time requirements for each task are described by specifying a mean, variance, and distribution type. One of seven standard or an empirical distribution can be selected. See Chapter III, Distributions, for the mean and variance field requirements for each distribution type. Using this task duration data, the main module randomly selects for each task processed, a task duration time from the specified distribution. Requirements for resources are defined in a manner to indicate the relationship of the resources to the specific task. Four distinct options are available to the user in describing this relationship. A brief description of each follows. The Consume and Generate options are described in detail as separate features later in this section.

a. Temporary Use. The resource is normally used during the entire task duration and, upon completion of the task, is returned to a pool for use by other tasks. With this option, use of such resources as men and equipment can be described.

b. Consume. The resource becomes an integral part of the item being processed, such as, an aircraft assembly becoming part of the aircraft and the assembly is not returned upon completion of the task. All consumable resources such as assemblies and sub-assemblies are described using this option. See the Consume feature description for more details.

c. Generate. A resource is generated by the specific task for processing as a separate item, e.g., assembly, subassembly, etc. This action is specified by defining a resource as an associated resource on the task. The generate task and all tasks subsequent to it (until another generate) will process the associated resource. The portion of the network beginning with the generate task no longer deals with or impacts upon the (next higher indenture) resource that was being processed at the time the generate task was reached. For each generate task processed in succession, the main module in effect, begins the processing of the next lower indenture resource. See the Generate feature description for more details.

d. Task Specific Resource Substitution. Alternate manpower resources can be specified on separate sets of task definitions. Refer to the Resource Substitution feature description in this chapter for a complete description of how this option fits into the overall Resource Substitution feature.

Tasks are defined on Form 12 and 12As. See Chapter VIII for the details of defining tasks.

6. Resource Description

Aircraft, men, parts, equipment, and their resources are an integral part of the LCOM II Simulation Software input requirements. During the operation of the Main Module, these resources can be consumed, (e.g., aircraft and parts) used and returned to a pool (e.g., men and equipment), or generated (e.g., reparable units). Resources are grouped into four categories or types and referred to as such for proper data collection. The categories: (1) aircraft, (2) parts, (3) personnel, and (4) equipment. Multiple resources in each category can be defined.

The number of resources that can be defined is basically unlimited, such that, the user may define resources, particularly parts, down to and including bits and pieces if desired, or the parts can be aggregated at any desired level. Resource authorized quantities can also be substantially high.

Multiple resource substitutions are specified at the time resources are defined. See Resource Substitution feature description in this chapter.

7. Generating Resources

Resources are generated in LCOM II in two ways: at the beginning of the simulation, and by processing a task in the task network. Generation is the establishment of a physical record to represent the resource and adjusting its on-hand quantity. In LCOM II there are two distinct types of resources, aircraft and non-aircraft. Non-aircraft may be designated as men, age, parts, or facilities, but for all practical purposes, they are treated in the main module similarly. These two types are discussed separately below.

a. Aircraft

At the beginning of the simulation a separate record is generated for each authorized aircraft. When generated, the default configuration (first one defined on Form 17 for that aircraft) is used unless the user specifies another one with a STORAC change card. These records are maintained throughout the simulation except when the aircraft are removed entirely from the simulation. The authorized quantity of aircraft will always equal the number of valid aircraft records in the simulation and the on-hand quantity will be equal to those aircraft not currently in-use, i.e., not processing within the network. The AUTH and AUTHA change cards can be used at time = 0.0 to increase or decrease this authorization.

Defining a task on Form 12 to generate an aircraft is done by placing an * in col 29 and specifying the aircraft name as the associated resource (col 30-35). This task can have other non-aircraft resources as required resources (col 37-63). When reaching this task in the network, the main module will generate the aircraft record and permit it to process the task itself and all subsequent tasks until end of network, when it will increase the on-hand quantity. When generated, the default configuration (first one defined on Form 17 for that aircraft) is used unless the user specifies another one with a GENRAT change card. Also, this aircraft has its own separate failure mechanism. At end of network, the aircraft is stored as available in this configuration, and the aircraft record is not released.

The configuration specified on the GENRAT change card applies to all generations of the specific aircraft.

b. Non-Aircraft

At the beginning of simulation, non-aircraft resources are not actually generated, but their on-hand quantity is set equal to the amount authorized. Throughout the simulation, these non-aircraft resources have no individual records except while they are processing a network. The AUTH, AUTHA, and SAUTH change cards can be used at time = 0.0 to increase or decrease this authorization. After simulation has started, the AUTH card can only be used to increase the authorized and on-hand quantities and will be effective immediately upon reading the change card; the SAUTH card can be used to either increase or decrease resources on a shift, but the change to the on-hand quantity will not be effective until the next time the shift specified begins.

Actual generation of a non-aircraft record is done by processing a task defined on Form 12 with an * in col 29 and the resource name as the associated resource (col 30-35). Only non-aircraft resources can be specified as required resources (col 37-63). This generated record will be used to process this non-aircraft resource until it reaches end of network. At that time, the record is destroyed and the on-hand quantity increased.

To sum up - Aircraft records are generated and maintained throughout the simulation until specifically removed. Non-aircraft records exist only while processing a section of network. Both aircraft and non-aircraft resources are released (on-hand increased) to the simulation upon completion of their network processing.

8. Consuming Resources

Resources are consumed during simulation by processing a task specifying a particular consumption or by reductions in authorizations thru the shift mechanism. Aircraft are also consumed thru attrition. (See Attrition Feature description.)

a. Aircraft Resources

To consume an aircraft on a task, it must be defined on Form 12 with the following characteristics. First, there must be no associated resource on the task, e.g. no * in col 29. Second, the only required resources in cols 37-63 must be the aircraft and a "single" consume. Third, no other required resources including time must appear on the task.

As in the generation of aircraft, the main module needs to know an aircraft configuration. The configuration is assumed to be the first one defined on Form 17 for the specific type aircraft unless the user has specified another one with a CONSUM change card. (See Chapter VII, Change Card description.) This configuration applies to all consumptions of the specific type aircraft.

If an aircraft of desired type and configuration is available, the model most effectively removes the aircraft from the simulation by reducing the on-hand by one and removing the aircraft record. A dummy task is inserted for the consume task and network processing continues.

If an aircraft of the desired type and configuration is not available, a single dummy task activity demanding the aircraft is created and backordered. This activity when satisfied with the aircraft effectively re-enters the network at the point in the network subsequent to the task consuming the aircraft. The aircraft record is removed from the simulation and the on-hand quantity is reduced by one.

b. Non-Aircraft Resources

To consume a non-aircraft resource it must be used on a task (defined on Form 12) as a required resource with a 'C' in the proper consume column (43, 52, or 61). No restrictions are made except where cannibalization is involved. If the task is used in the network with an I selection mode, only one type resource can be consumed on the task and then only by a quantity of one. Other non-aircraft resources can be identified as resources required (cols 37-63) or any resource can be identified as an associated resource (col 29-35).

Since non-aircraft resource records do not exist, i.e., there is really no resource to consume. Only the on-hand quantity is reduced by the consume amount. If any resource required on a task is not available, the task is backordered. When available, the task starts and upon completion, it doesn't release the resource back to the system, i.e., on-hand is not increased.

9. Failure Mechanism

a. General Description. The methodology for inducing resource failure into the simulator is designed to provide the greatest possible flexibility in use of this failure mechanism.

The basic mechanism can be thought of as a clock that is utilized to trigger action within the network. This clock is first set to some value, random variate or constant, then successively decremented by defined amounts when processing certain network tasks, until the value is zero. On reaching zero a failure of some sort has occurred, information is stored concerning where in the network this clock was referenced, the clock is reset in a manner similar to the original setting, and later successively decremented for the next failure.

Clocks can represent and be driven by almost any failure criteria such as, number of aircraft, sortie time, resource operating time, absolute time, etc., limited only by the users' ingenuity.

b. Setting the Clocks

Each clock is defined on Form 13 in terms of its mean, variance, and distribution type. The model uses these parameters to initially set and reset the clocks. With the exception of the triangular distribution, all standard and empirical distributions can be used.

In order to simulate a start-up condition, where all clocks are not at their maximum value at time = 0, all clocks are multiplied by a random number between 0 and 1.0, i.e., initial value will be a percent of

initial clock setting. The value of all clock parameters can be obtained by setting SWICH #11 to on (=1).

c. Using the Clocks

Clocks are used within the networks (Form 11) by specifying an F selection mode and using the clock as the parameter. The user can use a clock with an F selection parameter in more than one place in the network. When a clock reaches zero, information about all the locations in the network concerned with the clock are used to control the network processing. This information is provided to the resource whose network processing caused the clock or clocks to break.

d. Decrementing the Clocks

(1) Each task in the network assigned to decrement a clock or list of clocks is identified on Form 14. These tasks would have been previously defined on Form 12 and used in the networks on Form 11.

(2) The specific clocks that are to be decremented, the decrement mode, and value of the decrement are specified on Form 14.

(3) Any desired combination of failure setting and decrementing can be included in a simulation such as listing the same failure clock under two different decrement tasks and values. However, tasks can only be identified once on Form 14 and can only decrement by one mode.

e. Controlling Network Processing (F task stringing)

(1) Once the value of the clock reaches zero, a failure has occurred and the network processing mechanism for the aircraft must be informed which network F task gates are now opened by this failure. Here F task stringing comes into use.

(2) F task stringing is defined as: sequential tasks in the network being controlled by the same clock. A task in the network that is controlled by a failure clock (specified as the failure parameter) could be preceded by another task with a selection mode F, but contains no clock parameter (uncontrolled). The software effectively links the controlled and uncontrolled tasks by maintaining pointers to these tasks in the individual aircraft failure set called flow queue (FLWQ). All F tasks within a network section, whether it is controlled or uncontrolled, will be linked together under control of the final F task with clock parameter in the string of F tasks. See Figure 4-7.

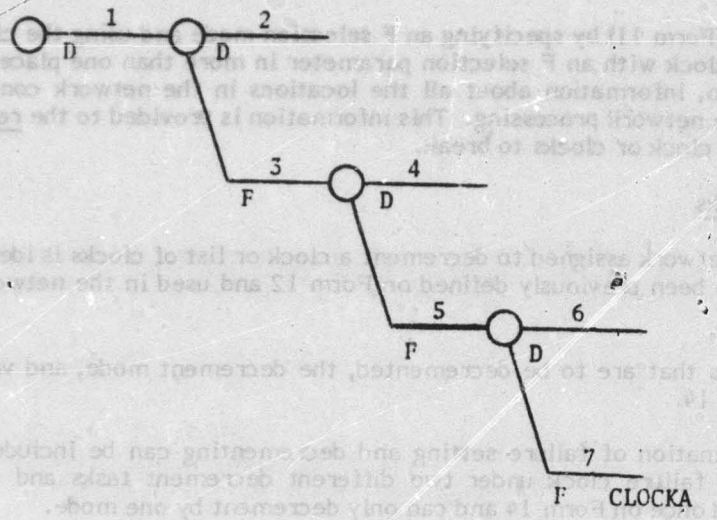
(3) All Properly Linked Network Locations including the triggering F location are stored in the FLWQ owned by the aircraft's network (NET) record. During network processing for the owner aircraft, when a task in the control table coded F selection is reached, the set FLWQ is searched for the Network Location under consideration. If found in FLWQ, processing will take place; otherwise, processing of that leg of the network stops at this point. When the resource entering the network (Forms 20) and all of the non-aircraft resources generated a result of its network processing have completed their network processing, the set FLWQ is released. This means that the F tasks controlled by a particular clock should follow any tasks that decrement the clock; otherwise, those tasks cannot be processed.

10. Halt Mechanism - H Selection Mode

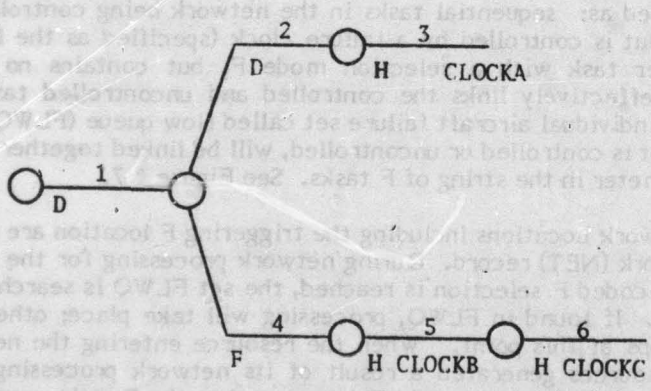
The H selection mode utilizes the Failure Mechanism Structure, but uses it in the reverse way the "F" mode does. Recall that if a failure clock has breached zero for a particular F task, that the task will be done. When a HALT clock breaches, the particular network location/s controlled by that H clock will not be processed, thus all subsequent network tasks will also not be accomplished. Multiple network locations can reference the same H clock for their control.

Consider the H as a failure generated stopping point in a particular leg of the network being processed. As implied here, the H selection is handled by the user just like that of the F with one exception; H tasks must be independent of each other, that is every H selection mode must have an H clock associated with it. This ensures that H tasks will not be strung out like Fs. See Figure 4-6.

Example A



Example B



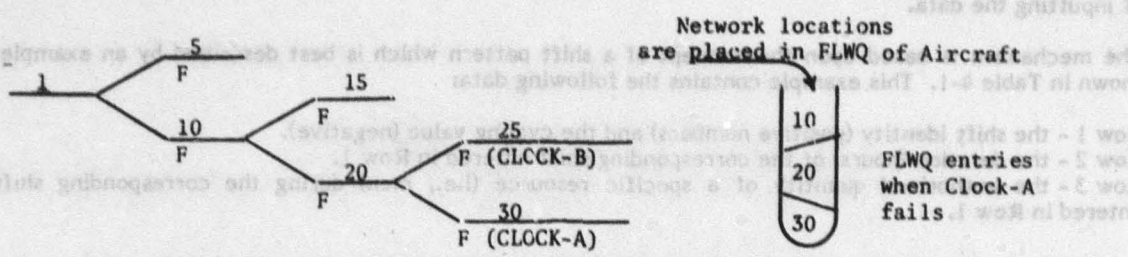
#A - This network is valid since tasks 3 and 5 are dependent on the single F clock at task 7.

#B - This network is valid since there is complete independence between the H clocks for tasks 3, 5, and 6. No stringing of Hs with Fs or other Hs is permitted. Task 4 and 5 will not string.

FIGURE 4-6. F/H SELECTION MODE RELATIONSHIP

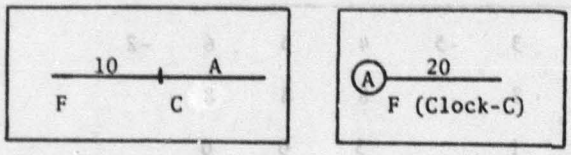
Example 1

In this example, the FLWQ contains data to control network processing triggered by a failure of CLOCKA. Tasks at locations 10 and 20 are controlled indirectly by this clock as they are coded F selection mode and lead directly to network location 30. Set FLWQ contains a 30, 20, and 10. If CLOCKB had failed the FLWQ would contain a 25, 20, and 10. If both had failed the FLWQ would have contained 30, 25, 20, and 10 (no duplicates).



Example 2

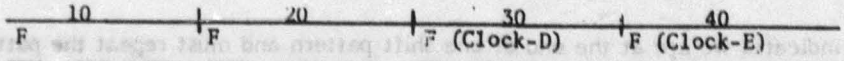
F Task stringing will not happen between network sections. In this example, these two F's will not string when Clock-C fails. FLWQ only contains a 20.



Example 3

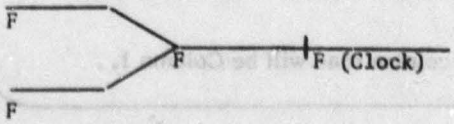
F Task stringing will be accomplished thru all preceeding F Tasks, even those with valid clock parameters.

- Clock-E's failure stringing will include locations 40, 30, 20, and 10 in the FLWQ.
- Clock-D's failure stringing will include locations 30, 20, and 10 in the FLWQ.



Example 4

Two F Tasks in parallel cannot lead to a single F Task controlled or uncontrolled because the model has no way of knowing which way to string back. Therefore, this networking is illegal.



Note: All numbers in the above networks represent network locations, not task numbers.

FIGURE 4-7 F TASK STRINGING

11. Shift Mechanism

The shift mechanism utilized in the model is a feature that is not limited to just describing personnel shift changes. By extension of the data, it can be used to externally control any resource quantities other than aircraft strength. Form 16 is used to input shift information. See Chapter VIII for details of inputting the data.

The mechanism is based upon the concept of a shift pattern which is best described by an example, shown in Table 4-1. This example contains the following data:

Row 1 - the shift identity (positive numbers) and the cycling value (negative).
Row 2 - the duration (hours) of the corresponding shift entered in Row 1.
Row 3 - the authorized quantity of a specific resource (i.e., men) during the corresponding shift entered in Row 1.

TABLE 4-1. EXAMPLE SHIFT PATTERN (5 DAYS THEN 2 DAYS)

	1	2	3	4	5	6	7	8
Shift Identity	1	2	3	-5	4	5	6	-2
Shift Duration	8	8	8		8	8	8	
Authorized Quantity (Man)	4	2	1		3	0	0	

The example is read as follows:

a. Column 1, Row 1, indicates this is shift #1.
Column 1, Row 2, indicates that shift #1 is 8 hours long.
Column 1, Row 3, indicates there are 4 men on duty during shift #1.

b. Columns 2 and 3 read similar to Column 1 with the exception of a different shift number and fewer men on duty.

c. Column 4 indicates we are at the end of one shift pattern and must repeat the pattern (Columns 1, 2, & 3) 5 times before continuing to Column 5. This represents a 5-day work week.

d. Columns 5, 6, & 7 read similar to Column 1. Note that although shifts #1, 2, and 3 were repeated 5 times, this is the 4th different shift definition/identity.

e. Column 8 reads similar to Column 4 indicating we must repeat the pattern (Columns 5, 6, & 7) twice. This represents a weekend.

f. With no additional entries in the table, the next column read will be Column 1.

The total period covered by the shift patterns need not be confirmed to seven days as in the example but can be anything. The example data in Table 4-2 indicates a period of nine days, each day of the first seven split into two 12-hour shifts, and the last two days are aggregated into one 48-hour entry.

TABLE 4-2. EXAMPLE SHIFT PATTERN (7 DAYS THEN 2 DAYS)

	1	2	3	3	5
Shift Identity	1	2	-7	3	-1
Shift Duration	12	12		48	-1

12. Defining Resources That Can Enter the Networks

Multiple aircraft can be defined on Form 13 by using the normal procedure of entering the resource name and defining its type as aircraft. These aircraft are automatically entered into the list of valid resources that can externally enter the networks. This aircraft name is used in Columns 20-25 (Aircraft ID Field) on Form 20. Aircraft can process either Mission or Activity requirements.

Resources other than aircraft can enter the networks but can only process Activity requirements. Entry permission is done by placing an asterisk in Column 11 of the Form 13 data record defining the non-aircraft resources and using that resource name in Columns 20-25 (Aircraft ID Field) on Form 20.

The Form 17 procedure for defining mission and activity processing on Form 17 is described in Chapter VIII.

13. Tail-Number-Tracking - Aircraft processing

A record of each aircraft within the simulation model is maintained from the first time the aircraft becomes part of the simulation until it leaves the simulation. This permits a tracking of the aircraft processing throughout the simulation, so that, at any point in time, the most recent historical aircraft actions, configurations, conditions, or usage are known. This is generally referred to as tail-number-tracking (TNT).

The TNT capability provides, through the aircraft records described, the necessary history data to permit the implementation of such features as Configuration Management, the outputting of the Realized Flying Schedule, KTIME switch mechanism, aircraft tracking (TRAKAC change card), etc. TNT aids many other features in performing their functions. No change in input data is required to cause the tail-number-tracking mechanism to operate since it is automatic.

Within the simulation aircraft are maintained in one of three major statuses; (1) available, (2) cocked, and (3) in-use. The available and cocked are those aircraft that are not currently processing and can be assigned to mission requirements. These two statuses and their impact on mission assignment will be thoroughly reviewed under the Configuration Management feature description.

The in-use aircraft are those that are processing within the networks. In order to further define where and under what condition the in-use aircraft are processing, the in-use status is subdivided into nine additional conditions or sub-statuses. However, keep in mind that the aircraft are still maintained in the in-use status. The aircraft are flagged while in this status to indicate the current processing. Available and cocked aircraft although maintained as such, are also assigned a flag value. Table 4-3 lists all these aircraft status flags and provides a description of each.

Many aircraft snapshot reports (i.e., BOSTAT, IPSTAT, MNSTAT, and QSTAT) include these aircraft status flags as an output item. TNT of aircraft processing can be readily observed as change of the aircraft from one flag value to another. Table 4-4 lists all possible flag value changes and provides a reason for each change.

TABLE 4-3. AIRCRAFT STATUS FLAGS

Flag Value	Status Description
0	Aircraft is available for a mission assignment (pre-sortie processing--required).
20	Aircraft is cocked, ready for immediate mission assignments.
40	This aircraft has completed pre-sortie task processing, but not enough other aircraft are ready to start sortie. This aircraft will wait until sufficient aircraft are available or until the mission is scrubbed.
60	Pre-sortie task processing complete and at least minimum number of aircraft are ready.
80	Aircraft is processing pre-sortie tasks or has completed them and mission has been cancelled or mission has flown without it.
100	Processing pre-sortie tasks towards a valid mission.
101	Processing pre-sortie tasks towards a valid mission and have processed at least one unscheduled maintenance task.
200	Aircraft processing post-sortie tasks.
250	Activity processing.
300	Aircraft is flying.
400	A cocked aircraft processing pre-sortie tasks for a mission requiring that AC's current configuration as its take-off configuration. Actually, processing pre-sortie portion of network to reach sortie task but task times are all zero time delay.
NA	Not applicable, no aircraft record exists.

NOTE: The "in-use" aircraft status contains all aircraft with flag values of 40 or greater.

TABLE 4-4. AIRCRAFT STATUS FLAG CHANGES

FLAG CHANGE	REASON
0 - 100	Satisfies a new mission request.
0 - 100	Satisfies an existing mission request.
0---NA	Removing an aircraft from the simulation by a "consume".
0 - 250	Satisfies new/existing activity request.
20 - 400	Satisfies a mission request (no reconfiguration).
20 - 100	Satisfies a mission request (reconfiguration).
20 - 250	Satisfies a new/existing activity.
20 - NA	Removing an aircraft from the simulation by a "consume".
40 - 60	Minimum aircraft requirement is ready.
40 - 80	Cancel time is reached and number of aircraft less than minimum.
60 - 300	At or after scheduled take-off time the min. or max. aircraft were ready.
60 - 80	Aircraft is a spare and the mission goes without it.
80 - 400	Aircraft at sortie task satisfies an existing mission.
80 - 20	Aircraft at sortie cannot satisfy a mission request.
100 or 101 - 40	Individual aircraft becomes ready for mission.
100 or 101 - 80	Aircraft not at sortie task and mission goes.
100 or 101 - 80	Aircraft not at sortie task and mission cancels.
200 - NA	Removing an aircraft from the simulation by attrition.
200 - 0	Aircraft post-sortie processing complete.
250 - 0	Aircraft activity processing complete.
250---20	Aircraft activity processing complete, cocked AC released as picked up.
250---20	Alert aircraft replenishment or release activity processing complete.
300 - 200	Aircraft lands.
400 - 40	Aircraft becomes ready for a mission.
400 - 80	Aircraft not at sortie task and mission goes.
400 - 80	Aircraft not at sortie task and mission is cancelled.
NA - 0	Adding aircraft to the system.

14. Configuration Management

a. General Description

Configuration management is the feature whereby users of LCOM II maintain significant external control of the aircraft usage. This control considers the aircraft's configuration which can be in terms of either external or internal configuration or both.

External configuration is normally descriptive of the ordnance loading of an aircraft or anything externally mounted that could change the use characteristics of an aircraft; for example, bombs, missiles, racks, etc. Internal configuration refers to a specific piece or set of internal equipment, whose condition (availability on the aircraft) also can change the use characteristics of an aircraft, for example a gun or a generator. With Configuration Management users control aircraft usage by configuration, aircraft changes of configuration thru reconfiguration, and aircraft selection based upon estimated times to prepare the aircraft for missions. Configuration control, however, is a users option and requires additional input data on Form 17 and preparation of Form 21. Instructions for filling out these forms are included in Chapter VIII.

A pseudo configuration control containing one configuration of aircraft and using a default search pattern is in operation when the configuration data is omitted, or old data packages are used. The Main Module maintains only one configuration of aircraft but still subdivides it into three major statuses described below, i.e., (1) Available, (2) Cocked, or (3) In-use aircraft.

b. Aircraft Statuses - Effect on aircraft assignments.

Aircraft are maintained by external configuration in one of three states: (1) available, (2) cocked (ready to go), and (3) in use. An aircraft is considered available if it is ready for assignment but requires the processing of the pre-sortie tasks before a sortie can be accomplished. A cocked aircraft is one that could fly immediately on some missions, that is, it's fully configured and requires no processing of pre-sortie tasks. However, a cocked aircraft assigned to a mission that requires the aircraft's reconfiguration will be treated as an available aircraft for the purpose of pre-sortie task processing. An in-use aircraft is just that, it is processing some piece of network or is on the sortie task. Available and cocked aircraft are both capable of being assigned to mission requirements; in-use aircraft are obviously not usable for assignment.

Aircraft get into the available and cocked states in the following manner. When an aircraft completes its flight and all its maintenance (reaches end of network), an attempt is made to immediately reassign it to any mission. If it is not needed, it is placed in the post-sortie external configuration (defined on Form 17) as an available aircraft. When an aircraft is prepared to fly but does not, an attempt is made to reassign it to a mission. If the aircraft is not needed in either a cocked or non-cocked condition, then it is placed in the pre-sortie external configuration (defined on Form 17) as a cocked aircraft. An aircraft might not fly, if the mission it was assigned to had been flown without it or was cancelled, or if the aircraft had been originally designated a spare and was not destined to fly. See also Chapter VIII, para J-3.

c. Aircraft Search Patterns

(1) Acceptable/Non-Acceptable Configuration

A search pattern is a sequential list of acceptable aircraft configurations and statuses that can be considered in the mission assignment process. This list is ranked in order of configuration and status acceptability for assignment, where the first one listed is the most acceptable and the last one the least acceptable. By simply omitting a configuration from a search pattern, it automatically becomes unacceptable for missions using that search pattern. Search patterns are defined on Form 21. Each aircraft mission or activity defined on Form 17 can specify which search pattern to use to assign aircraft for any requirement for that mission or activity.

(2) Reconfiguration Requirements and Networks

Reconfiguration is that action which takes an aircraft of one configuration or an unconfigured state and converts it to another configuration. Special networks are defined by the user for this purpose. In the case of external configurations, those networks might contain tasks which download one type of ordnance and upload another or the uploading of one type of ordnance on a clean or externally unconfigured aircraft.

Generally, the first configuration in the search pattern specified by a mission contains the configuration requiring the least effort to convert the aircraft from (reconfigure) to the configuration which the mission required (defined as the Pre-Sortie External Configuration on Form 17). Normally, the most acceptable status would be first a cocked then an available aircraft of that configuration. However, this is entirely under user control through his establishment of the search patterns on Form 21.

When a configuration other than what is needed for the mission is used, it must be first changed to the required configuration, i.e., reconfigured. This is accomplished through the use of the reconfiguration networks.

(3) Simplified Aircraft Assignment Search Pattern Example

Assume the user established the search pattern for a mission in the most logical order, i.e., (1) cocked in the required configuration, (2) available in the required configuration, (3 thru N) available in other configurations, and (N thru M) cocked in the other configurations. Upon notification of a mission request (frag) the aircraft are selected according to the user defined (Form 21) search sequence. First, if there is an aircraft in the cocked state of the configuration required for the mission, the aircraft will be selected for the mission and all its pre-sortie tasks will be omitted. If no aircraft are cocked, then one in the available state of the required configuration is used, and the aircraft begins its pre-sortie tasks. When no aircraft are available in the required configuration, the remaining configurations may be searched. This time, an "available" aircraft is selected first, configured or reconfigured to the required configuration, then begins its pre-sortie tasks. Finally, if there are no available aircraft in the remaining configurations, remaining configurations would be selected, unconfigured and reconfigured to the required configuration and then begins its pre-sortie task. As can be seen, when using this most logical order, less time is lost in making the mission by using aircraft in configurations and statuses at the top of the search pattern order. However, the user can define any order to simulate the conditions established for his simulation runs.

(4) Cut-off Time - time based control of aircraft assignment. On the Form 21, there is a cut-off time for each configuration specified in the sequential list of acceptable configurations. This time is a key factor in controlling the use of the associated configuration. Its value should be at least as great as the average time to process the pre-sortie tasks plus any reconfiguration networks specified.

The average time to process pre-sortie tasks should include the sum of the mean task times for: (1) all required tasks between the entry point and the sortie task that together form the minimum time-line for the pre-sortie portion of the network, and (2) any portions (or none) of the remaining pre-sortie tasks, such as, J selection mode tasks or tasks with some probability of not being accomplished.

The simulation software compares the cut-off time value to the remaining time till mission cancellation and when insufficient time remains, an aircraft in the associated configuration is skipped. This feature permits the user to specify configurations earlier in the search pattern that are more preferable, but take longer to prepare than those configurations further down in the search pattern. Conversely, it permits placing more acceptable configurations, with respect to preparation time, further down in the search pattern list in order to maintain more of them for some other mission or activity.

Cut-off times are important and provide significant user control over the aircraft selection process.

d. External/Internal Configurations

Up to this point, the word configuration has been used in a very generalized manner and most often referred to in examples in terms of ordnance or external configurations. A more detailed explanation of the external configuration, internal configuration, and reconfiguration networks applicable to each will be described within the summary and example description that follows: the configuration management feature permits the use of either external configurations only, internal configurations only (with a single or dummy configuration), or a combination of them both. Form 21 works with Form 17 to utilize the external configuration, while internal configurations require additional data on Form 21 and completion of Form 22 and 23 described later.

(1) External Configuration

External configuration can be used to represent weapons loads and other mission related configuration attributes. Each aircraft, by tail number is carried in one external configuration class at any given time. The external configuration class for all aircraft of a particular type at the start of simulation will be either the first configuration specified on Form 17 for that aircraft type or as specified on a "STORAC" change card. The pre-sortie external configuration class specified on Form 17 is assigned to each aircraft that starts processing pre-sortie networks for a specific mission name. It changes to the post-sortie external configuration specified on Form 17 upon completing the sortie and maintains that configuration throughout all post-sortie processing. Form 17 also identifies the aircraft assignment search pattern that specifies the sequential order in which aircraft classes are to be searched, obtained, and/or reconfigured to meet the mission requirements.

These search patterns are defined on Form 21. For each mission name, it lists in order of preference the desired external class name, cocked or available status, reconfiguration network entry node (if reconfiguration required), and cut-off time in hours to cancellation. If whenever the remaining time to cancellation is less than the specified cut-off for a listed configuration, that configuration will be skipped in the search for aircraft to assign to the mission. If the minimum aircraft have already been assigned and are ready to fly, the cut-off time test uses the scheduled take-off time instead of cancel time. If the cut-offs are properly based on task times for reconfiguration and pre-sortie processing, this feature will prevent aircraft from being prepared for missions they cannot make. Space is provided for two configuration choices on each line of the Form 21. Continuation cards ("C" in Col 11) can be used for additional configuration choices for the same mission name. The order of search for a given mission name is first line left entry, first line right entry, second (continuation) line left entry, second line right entry, third (continuation) line left entry, etc.

Cocked aircraft are aircraft that completed pre-sortie processing for a mission (as prime or spare) but did not fly. They carry the pre-sortie external configuration class of the mission they missed. If a Form 21 calls for a cocked aircraft and blank reconfiguration nodes, the aircraft will go directly to the sortie task, by passing through all pre-sortie processing in zero time. This can be unrealistic in some situations where pre-sortie launch networks should be processed by cocked aircraft. To correct this, it is suggested that external configuration be used to identify loads, that loading tasks be placed in reconfiguration networks, and that pre-sortie networks only include launch tasks (walkaround, engine start, etc). If a non-blank dummy node name is placed in the external reconfiguration field when no reconfiguration is required, properly loaded cocked aircraft will proceed through the pre-sortie launch network in the same manner as available aircraft.

Aircraft are searched and selected for missions exactly in the order listed on Form 21, except that a listed choice will be skipped when time remaining to cancel or scheduled take-off, whichever is appropriate, is less than the specified cut-off. If a particular configuration and cocked/available status is not listed for a specific mission name, it will never be considered for that mission. The user must take care to assure that all possible configurations that could occur in the course of simulation have some disposition on Form 21.

(2) Internal Configuration

For each internal configuration, a list or group of internal equipment required to be operative are specified on Form 23. Generally, only equipment on which maintenance will be deferred for some mission types need be considered. Equipment names and quantities required are listed. An aircraft may have four generators, but may be able to fly a given mission if at least two are operative. These groups of required equipment are referenced on Form 21. Alternate choices should be listed on Form 21 identifying selection order of aircraft internal configurations to be prepared and the internal reconfiguration entry nodes of the repair networks. The same Form 23 groups of equipment may be referenced by several different mission entries on Form 21 for the same aircraft type.

The internal configuration triggers are specified in the networks as "T" selection nodes. Only selection mode D can be used from the same node as a "T" but when used in this manner, the user should be sure of what is being done. Also, be sure the "T" branch occurs first in the Form 11's before its parallel branches. The effect of each "T" selection mode, trigger node is specified on Form 22. A trigger node will either add or subtract a quantity of one of the specified equipment from the internal configuration status of the aircraft processing through the "T" node. The initial authorized quantity of each item on every aircraft at the start of simulation is also given on the Form 22 when defining the trigger node.

"T" nodes that subtract can be placed following failure clocks in lieu of repair networks on deferrable equipment. "T" nodes that add can be used in internal reconfiguration networks that repair equipment needed for a given mission.

e. Example Configuration Management Problem

Use of the configuration management feature is illustrated by the following example problem. Three missions are used in the A-99 scenario and the main networks are illustrated in Figure 4-8.

MISSION I.D.	NETWORK ENTRY NODE	PRE-SORTIE PROCESSING TIME OF UNCOCKED A/C	DESCRIPTION
FERRY	MN100	1.67	Transporting aircraft
RECON	MN200	1.83	Surveillance
INTRD	MN300	1.92	Offensive penetration

Both external and internal reconfiguration is performed in the scenario and is described as follows:

EXTERNAL RECONFIGURATION ENTRY NODE	NETWORK DESCRIPTION	MEAN PROCESSING TIME (HRS)
ERC100	Download racks	.5
ERC200	Upload pod	.5
ERC300	Upload racks and pod	1.0
ERC400	Upload bombs	.75
ERC500	Download pod and upload bombs	1.25
ERC600	Upload racks and bombs	1.25

INTERNAL RECONFIGURATION ENTRY NODE	NETWORK DESCRIPTION	MEAN PROCESSING TIME (HRS)
IRC100	Mount 1 camera	.75
IRC200	Mount 2 cameras	1.5
IRC300	Mount 1 gun	1.0
IRC400	Mount 1 camera and 1gun	1.75

The internal reconfiguration network necessary to mount 1 camera and 1 gun is shown in Figure 4-9. Note the trigger nodes that are used. The networks needed for the other internal reconfiguration actions are similar to the one defined in Figure 4-9, and are therefore not shown. Networks for the external reconfiguration are also not shown.

The Forms illustrated in Figure 4-10 describe all the information needed for internal and external reconfiguration in the A-99 scenario. These are forms 17, 21, 22 and 23. Recall that Form 17 permits the definition of the mission, its parameters, and the aircraft search pattern it will use to obtain aircraft for the mission. Form 21 is where the sequence of aircraft search is specified by both external and internal configuration. Note that the user can now differentiate by aircraft status (cocked or available) within the configuration in terms of order of search. Form 22 and 23 are used strictly for internal configuration parameters.

In Figure 4-10 there are three missions specified on Form 17, each using a different search pattern for configuration management. The Pre-Sortie External Configuration for each mission is described as the configuration the A-99 aircraft should be in before flying the sortie. This configuration is the first one searched for (cocked then available) in each of the search patterns specified on Form 21. Also, not all the enternal configurations concerned with the total scenario are searched within each search pattern. Only the configurations which the user determines to be important for the particular missions should be searched. These restrictions are incorporated in SP1 due to the relatively low priority of this mission.

The cut-off time specified on Form 21 is obtained by adding the pre-sortie processing to the mean processing time for reconfiguration and multiplying it by 1.1. The multiplication is performed to provide additional processing time to increase the probability of accomplishing all pre-sortie tasks (including reconfigurations)

At the start of simulation, all A-99 aircraft are internally equipped with 2 cameras and 1 gun as specified on Form 22. The RECON mission calls for 2 cameras to be on the aircraft. In search pattern SP2, a search is initially made for aircraft configured with 2 cameras (GP1), and if located, are not to be reconfigured. If enough aircraft cannot be located with 2 cameras, then a search pattern is made for aircraft with 1 camera (GP2) then a search is performed to find an aircraft with no cameras (GP5). When they are located, they are internally reconfigured to contain 2 cameras. The sequence of the searches is very important and only those groups or combinations of internal equipment specified on Form 23, which are unique need to be included. For instance, in this scenario three groups are needed for SP2 and four groups are needed for SP3. It is unnecessary to specify a group which checks for zero cameras only because GP5 already checks for that, and group GP5 is also needed in SP3.

The quantity which is specified on Form 23 is the least quantity which needs to be operative on the aircraft. So, in the case of group GP3, the group would be satisfied if 1 gun is operative and any number of cameras are operative. However, the order that the groups of internal equipment are checked is also important. In search pattern SP3 group GP4 is checked for the external configuration BMS500. If GP4 is not on the aircraft, a search is performed for an aircraft with the same external configuration and group GP3. In this case it is known that if GP4 is not satisfied, then the aircraft that are searched do not have a gun or a camera, or has neither. So if enough aircraft are located that satisfy GP3, then the aircraft need only to be reconfigured for an additional camera.

This example problem does not illustrate all of the possible configuration management situations that can occur, but from what is implemented, several basic conclusions can be drawn. In regards to the search patterns defined on Form 21, the external configuration which should be searched for first, should be the Pre-Sortie External Configuration specified on Form 17 for the particular search patterns. The list of external configurations for each search pattern need not include every possible configuration, but the configurations included should be chosen with care. The Cut-Off Time specified for each configuration should represent as accurately as possible the mean processing time for reconfiguration plus the pre-sortie processing time for uncocked, i.e. available aircraft. The sequence and order of the internal configuration searches will determine the necessary unique internal groups to specify. Finally, particular care should be observed to ensure that the trigger nodes are set up properly in the reconfiguration networks in order to prevent a change in internal equipment quantity balances that causes the maximum specified on Form 23 to be exceeded or causes a negative value.

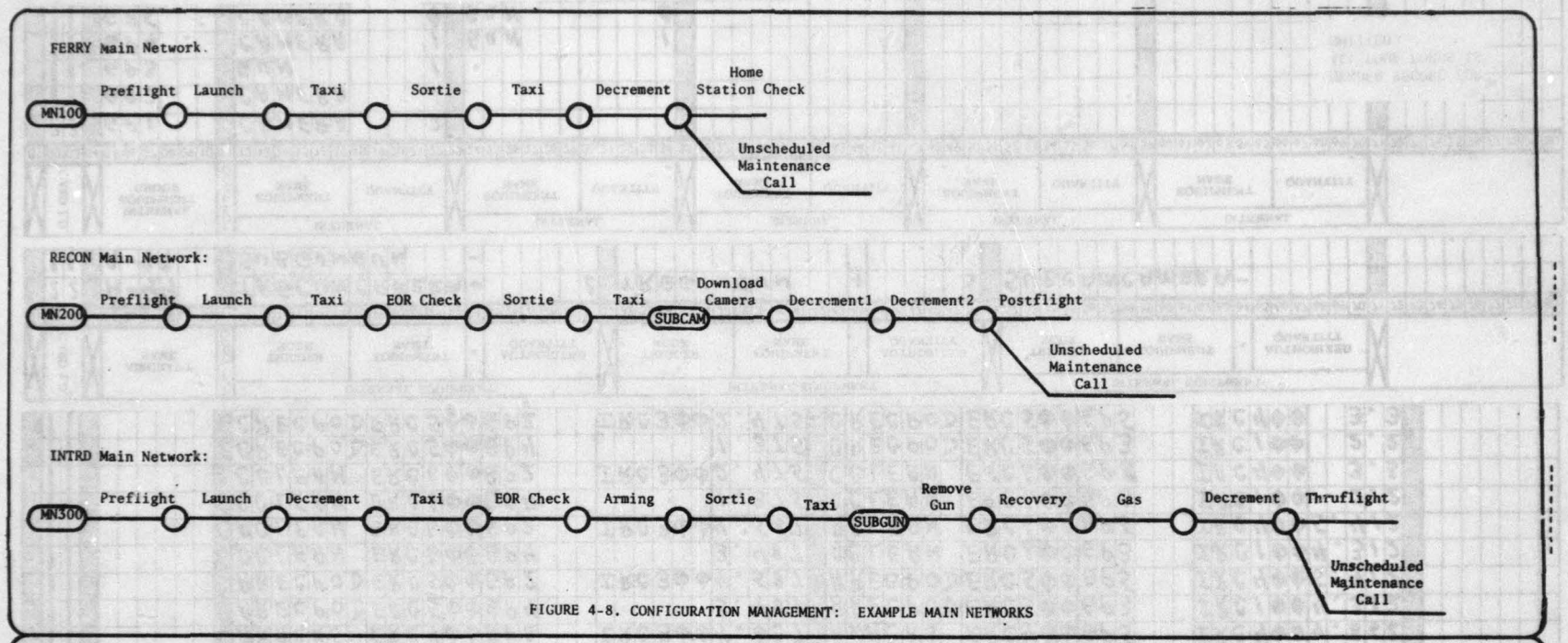


FIGURE 4-8. CONFIGURATION MANAGEMENT: EXAMPLE MAIN NETWORKS

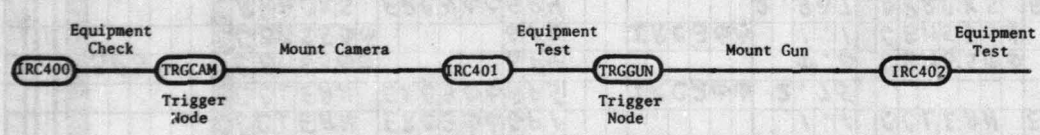
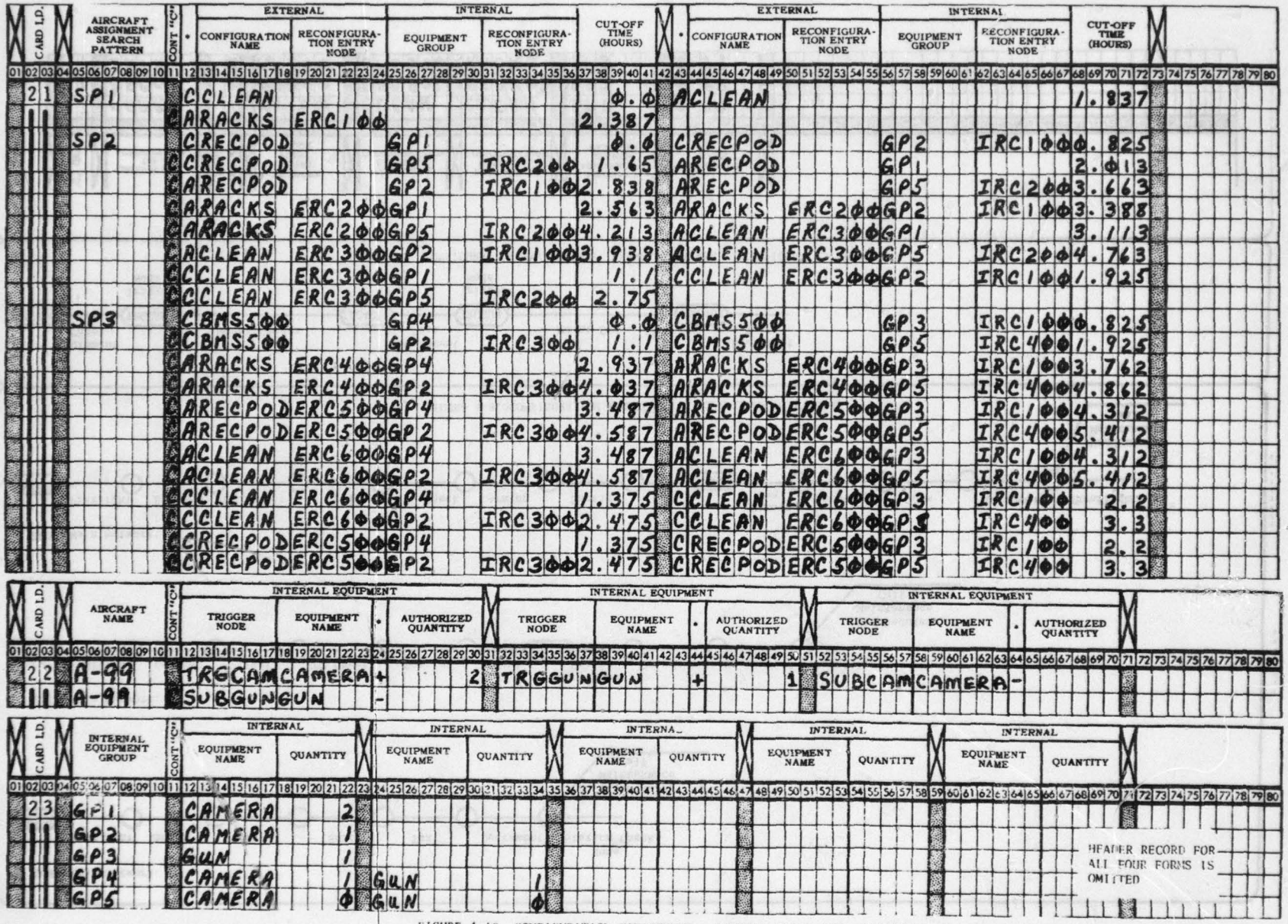


FIGURE 4-9. CONFIGURATION MANAGEMENT: EXAMPLE INTERNAL RECONFIGURATION NETWORK

CARD I.D.	MISSION I. D. OR ACTIVITY I. D.	REPORT COLUMN	NETWORK ENTRY POINT NODE	PRE-SORTIE EXTERNAL CONFIGURATION	POST-SORTIE EXTERNAL CONFIGURATION	AIRCRAFT ASSIGNMENT SEARCH PATTERN	AIRCRAFT NAME
17	FERRY	1	MN1ΦΦ	CLEAN	CLEAN	SP1	A-99
11	RECON	2	MN2ΦΦ	RECPOD	RECPOD	SP2	A-99
11	INTRD	3	MN3ΦΦ	BMS5ΦΦ	RACKS	SP3	A-99



CARD I.D.	AIRCRAFT ASSIGNMENT SEARCH PATTERN	CONT "C"	EXTERNAL CONFIGURATION NAME	EXTERNAL RECONFIGURATION ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIGURATION ENTRY NODE	CUT-OFF TIME (HOURS)	EXTERNAL CONFIGURATION NAME	EXTERNAL RECONFIGURATION ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIGURATION ENTRY NODE	CUT-OFF TIME (HOURS)
21	SP1		CCLEAN				.0	ACLEAN				1.837
			ARACKS	ERC100			2.387					
	SP2		CRECPOD		GP1		.0	CRECPOD		GP2	IRC1000	.825
			CRECPOD		GP5	IRC2000	1.65	ARECPOD		GP1		2.013
			ARECPOD		GP2	IRC1000	2.838	ARECPOD		GP5	IRC2000	3.663
			ARACKS	ERC2000	GP1		2.563	ARACKS	ERC2000	GP2	IRC1000	3.388
			ARACKS	ERC2000	GP5	IRC2000	4.213	ACLEAN	ERC3000	GP1		3.113
			ACLEAN	ERC3000	GP2	IRC1000	3.938	ACLEAN	ERC3000	GP5	IRC2000	4.763
			CCLEAN	ERC3000	GP1		1.1	CCLEAN	ERC3000	GP2	IRC1000	1.925
			CCLEAN	ERC3000	GP5	IRC2000	2.75					
	SP3		CBMS5000		GP4		.0	CBMS5000		GP3	IRC1000	.825
			CBMS5000		GP2	IRC3000	1.1	CBMS5000		GP5	IRC4000	1.925
			ARACKS	ERC4000	GP4		2.937	ARACKS	ERC4000	GP3	IRC1000	3.762
			ARACKS	ERC4000	GP2	IRC3000	4.037	ARACKS	ERC4000	GP5	IRC4000	4.862
			ARECPOD	ERC5000	GP4		3.487	ARECPOD	ERC5000	GP3	IRC1000	4.312
			ARECPOD	ERC5000	GP2	IRC3000	4.587	ARECPOD	ERC5000	GP5	IRC4000	5.412
			ACLEAN	ERC6000	GP4		3.487	ACLEAN	ERC6000	GP3	IRC1000	4.312
			ACLEAN	ERC6000	GP2	IRC3000	4.587	ACLEAN	ERC6000	GP5	IRC4000	5.412
			CCLEAN	ERC6000	GP4		1.375	CCLEAN	ERC6000	GP3	IRC1000	2.2
			CCLEAN	ERC6000	GP2	IRC3000	2.475	CCLEAN	ERC6000	GP5	IRC4000	3.3
			CRECPOD	ERC5000	GP4		1.375	CRECPOD	ERC5000	GP3	IRC1000	2.2
			CRECPOD	ERC5000	GP2	IRC3000	2.475	CRECPOD	ERC5000	GP5	IRC4000	3.3

CARD I.D.	AIRCRAFT NAME	CONT "C"	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY
22	A-99		TRGCAM	CAMERA	+	2	TRGGUN	GUN	+	1	SUBCAM	CAMERA	-	
	A-99		SUBGUN	GUN	-									

CARD I.D.	INTERNAL EQUIPMENT GROUP	CONT "C"	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY
23	GP1		CAMERA	2								
	GP2		CAMERA	1								
	GP3		GUN	1								
	GP4		CAMERA	1	GUN	1						
	GP5		CAMERA	0	GUN	0						

HEADER RECORD FOR ALL FOUR FORMS IS OMITTED

FIGURE 4-10 CONFIGURATION MANAGEMENT EXAMPLE INPUT DATA (FORMS 21, 22, and 23)

15. Priority System - Start, Pre-empt, Expedite, Backorder, and Overtime

The priority system in the software is a flexible scheme designed to provide the user with adequate external controls for its operation and to ensure that the simulation processes jobs in a manner similar to the real world. External controls are input on Form 18. Chapter VIII describes this input in detail.

The priority system structure contains 3 broad categories of priorities. Within these categories, there are several individual levels or values of priorities. These values represent the relative priority, where the lowest number is the most urgent priority, i.e., 9 is higher priority than 15.

This system can best be described with the example in Figure 4-11. This example uses the default system values assigned by the Main Module, which can be changed by the user on Form 18.

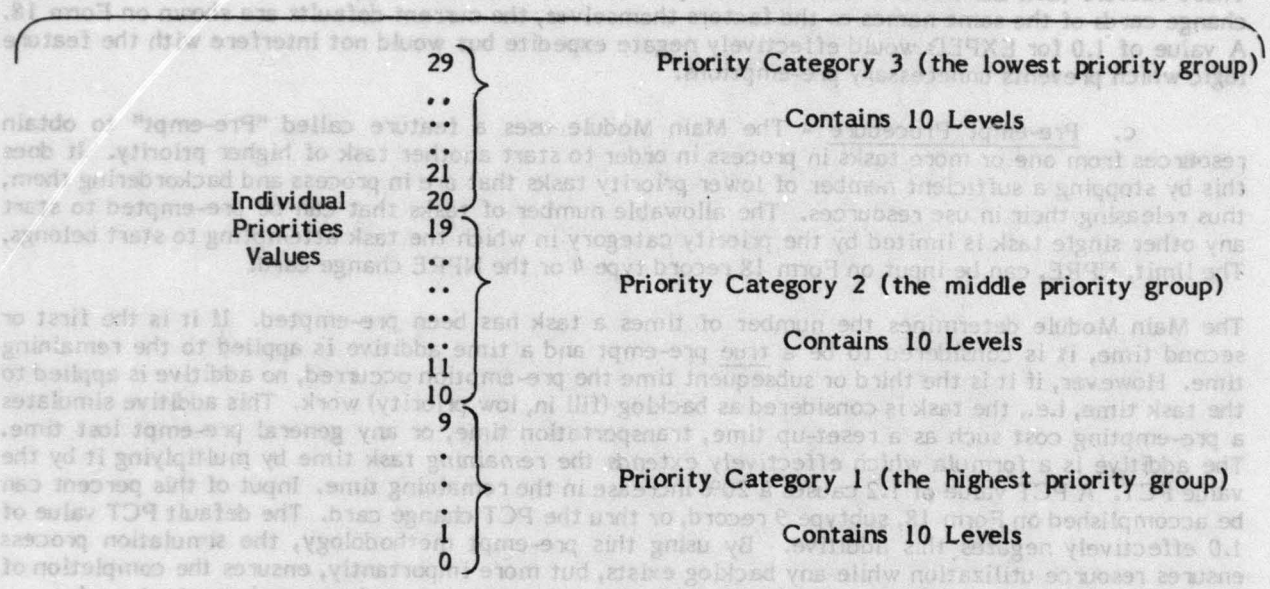


FIGURE 4-11. DEFAULT PRIORITY STRUCTURE

All tasks are initially given a priority equal to the lowest value (highest number) within the assigned priority category. Hence, if a task is assigned to category 2 on Form 12 (column 13), it would, when first started, be given a priority of 19. However, when the tasks are used in the presortie networks and the mission has not been cancelled the tasks will be given an initial priority equal to the mission priority specified on Form 20 (column 65, 66).

The following provides a brief description of the task, starting, expediting, preempting, and backordering procedures.

a. Start Procedure - The task starting procedure uses the task priority as the main selection factor (most urgent first) and where priorities are equal, the task duration time as the second selection factor (shortest first). See also LCNT change card description.

b. Expedite Procedure - Defined for each priority category is a priority waiting factor, PWAIT, which equals the amount of time a task within that category will wait to obtain resources prior to applying pre-emption. Individual task priorities are used only to determine which category they are currently within and its PWAIT factor is used. Also a general factor EXPED is defined.

When a task requires a resource that is not available, the following actions take place:

(1) Lower priority in-process tasks are evaluated as to whether they can be completed within the allowable waiting PWAIT, of the higher priority task. If so, the higher priority task will wait.

(2) If not, application of the expedite factor (EXPED multiplied by the remaining time) is tested with the same question. If time is now within the allowable wait time, PWAIT, the task will wait and the expedite factor is actually applied to the remaining time of the in-process task that will be releasing the resources

(3) If allowable wait time, PWAIT, is still exceeded and no lower priority, in-process task can provide the resources by this procedure, the model will then attempt to pre-empt a sufficient number of lower priority tasks to provide the resources.

These factors (EXPED and PWAIT), can be input on Form 18, record type 8 and 5 respectively or on change cards of the same names as the factors themselves, the current defaults are shown on Form 18. A value of 1.0 for EXPED would effectively negate expedite but would not interfere with the feature logic which prevents unnecessary pre-emptions.

c. Pre-empt Procedure - The Main Module uses a feature called "Pre-empt" to obtain resources from one or more tasks in process in order to start another task of higher priority. It does this by stopping a sufficient number of lower priority tasks that are in process and backordering them, thus releasing their in use resources. The allowable number of tasks that can be pre-empted to start any other single task is limited by the priority category in which the task attempting to start belongs. The limit, NPRE, can be input on Form 18 record type 4 or the NPRE change card.

The Main Module determines the number of times a task has been pre-empted. If it is the first or second time, it is considered to be a true pre-empt and a time additive is applied to the remaining time. However, if it is the third or subsequent time the pre-emption occurred, no additive is applied to the task time, i.e., the task is considered as backlog (fill in, low priority) work. This additive simulates a pre-empting cost such as a reset-up time, transportation time, or any general pre-empt lost time. The additive is a formula which effectively extends the remaining task time by multiplying it by the value PCT. A PCT value of 1.2 causes a 20% increase in the remaining time. Input of this percent can be accomplished on Form 18, subtype 9 record, or thru the PCT change card. The default PCT value of 1.0 effectively negates this additive. By using this pre-empt methodology, the simulation process ensures resource utilization while any backlog exists, but more importantly, ensures the completion of low priority work while maintaining overall availability of the resources for more important work.

The shift mechanism uses the overtime and pre-empt features whenever a shift change occurs that lowers authorizations and enough authorizations cannot be obtained from the onhand balance. The shift mechanism first checks to see if any jobs in process could finish within the overtime allowance for their category. If more authorizations are still needed, the shift mechanism checks to see if expediting jobs would allow them to finish. If number needed still not satisfied, it pre-empts jobs to get the remainder of the needed authorizations.

d. Backorder Procedure

If a task is placed into backorder, either because it could not start due to insufficient resources or it was pre-empted by a higher priority task, then the task's priority is escalated in proportion to the amount of time it is backordered. For every unit of time in backorder equal to a delta value, the task priority is increased by one (made numerically one less). Tasks can crossover from one category to another. This delta time is input on Form 18 record type 7 or with the DELT change card.

16. Cannibalization and the Network I Selection Mode

a. General Description

The purpose of the cannibalization feature is to obtain aircraft for a mission at frag time through a cannibalization action, when the on-hand balance of the aircraft is less than the minimum required. Several items work together to control the use of this feature.

The SWICH #10 change card is used to enable the feature (SWICH(10)=1,on) or disable it (SWICH(10)=0,off). The user must set SWICH #10 on or cannibalization will not take place since the SWICH #10 default is off.

Cannibalization cannot take place unless the I selection mode task is used. The I mode specifies those tasks containing part consumptions that can take advantage of cannibalization.

The I (ignore) mode also indicates that the time specified is a cannibalization removal time. During normal processing where the part is obtained from supply (on-hand quantity is greater than zero) the time is to be ignored. However, if the part is unavailable from supply, the task would be backordered and the aircraft would probably be NORS. For any subsequent satisfying of this part demand by a cannibalization action, the time and manpower resources specified on the I mode task would be used as the removal time and resource.

When activated, cannibalization reviews all in-use aircraft to qualify them as candidate donors or candidate acceptors. Only NORS aircraft can be considered as either donors or acceptors. Given that the donors and acceptors are qualified, the Main Module then determines if the manpower resources on the I mode task are available. If so, and donors and acceptors are matched up, the Main Module; (1) simulates the removal of the part from the donor, (2) dedicates the part to the acceptor, (3) delays the processing of the acceptor part demand task until the part is available, and (4) establishs a like demand for the part on the donor aircraft (A copy of the acceptor network from the I mode task to the end of network is filed against the donor AC).

Other external controls are available to the user. The maximum number of part demands that can be satisfied by cannibalization to obtain an aircraft has a default value of two (2). Also the maximum number of holes on (parts obtained from) a donor aircraft that can be made through cannibalization has a default of five (5). The CANNIB change card allows user input of these quantities, by aircraft type.

The user may, in his network, control where he wants a part consumption task considered for cannibalization action by use of the I selection mode as previously described. However, using the same task elsewhere in the network without the I selection mode or any other part demand task without the I mode, no cannibalization will be considered for the tasks in these instances.

There can be only one of a particular part cannibalized at a time for a particular aircraft. If more than one demand for a part is backordered, all demands except the last must be satisfied before cannibalization could be used.

b. Rules

To recap. The rules generating the use of cannibalization are:

(1) SWICH #10 must be set to one (1).

(2) I selection mode must be used on tasks with a part consumption to be considered for cannibalization.

(3) Only a single part consumption and men resources are permitted on an I mode task.

(4) If the I mode is used, the task time is always ignored except during cannibalization.

(5) If the I mode is used on a task without a consume on it, the Input module assumes the mode is D (DO), makes the substitution, gives a message, and continues.

(6) The CANNIB change card can reset the maximum no of parts to cannibalize for, and maximum no. of holes permitted on an aircraft caused through cannibalization.

(7) Acceptor Aircraft - Aircraft which satisfy the following conditions are set up as candidate acceptor aircraft:

(a) No scheduled or unscheduled jobs are in process.

(b) At least one part is backordered.

(c) Only parts are backordered.

(d) Aircraft in post sortie or activity processing.

(e) Tasks backordered and eligible for receiving a cannibalized part must be the only jobs backordered for the aircraft.

(f) The number of tasks backordered and eligible for receiving a cannibalized part must be less than or equal to a limit determined by the user.

(g) The aircraft cannot be waiting for dedicated parts from a previous cannibalization action (be a current acceptor).

(h) The aircraft cannot have an in-process donation to another aircraft (be a current donor).

(9) Donor Aircraft - Aircraft which satisfy the following conditions are set up as candidate donor aircraft:

(a) No scheduled or unscheduled jobs are in process.

(b) At least one part backordered.

(c) Only parts are backordered.

(d) Number of jobs backordered plus in-process removals must be less than the maximum no of holes (limit) permitted on the aircraft.

(e) Cannot be waiting for dedicated parts from a previous cannibalization action (be a current acceptor).

(f) Must be post-sortie or activity processing or an aircraft pre-sortie processing whose mission has flown or canceled.

17. Performance Summary Report (PSR) Partitioning - See Main Module PSR report description.

a. General Description

This feature permits the user to select which Performance Summary Report (PSR) statistics he wants printed. It affects only the Level 1 PSR and is activated by a change card, PSROUT. If no PSROUT cards are input, printing of the Level 1 PSR is done exactly as it always has been.

Level 2 reports are unaffected by this feature and will print in full. Also, the outputs to the GRAPH program are not changed in any way. Finally, there is no affect on the warmup period. The capability changes only the printing of the Level 1 statistics. Calculations are still accomplished as if the statistics were to be printed.

b. Feature Activation/Use

Change card PSROUT is used and specifies in the FPAR field a point in time when the special print request is to be activated. (See Change Card write-up for format.) Immediately following this change card is a request card specifying the statistics or group of statistics to be printed.

The format of this request card is free form, in that, the entries (statistic numbers) may be placed in

any column, between Col 1-72. Entries must be separated by at least one blank space or a comma and an asterisk (*) preceded by a blank must follow the last entry. The asterisk at the end of the set of requested statistics permits the use of more than one request card. This asterisk must only be on the last request card entered.

Entire groups of statistics (such as AIRCRAFT) can be specified if all statistics in that group are needed. A particular group is specified by appending the letter G to the group number, e.g., G2, with no intervening space between the G and the 2. Group numbers have been assigned sequentially to the sections of statistics as printed in the PSR with the OPERATIONS Section as G1, AIRCRAFT-G2, PERSONNEL-G3, SHOP REPAIR-G4, SUPPLY-G5, and EQUIPMENT-G6. Both groups and specific statistics numbers can be intermixed in any sequence.

Statistic numbers are not those seen on the PSR print-out but are sequentially assigned and will be the same as the sequence numbers printed on the Decoder run output using the SPEC option GRPD=nn.

An example of a request for 3, 6, 23, 24, 49 and all of Group 3 to be printed from the 30th day on would be:

```
PSROUT                    30.0
3,6,G3,23,24,49           *
```

Any PSROUT request remains in effect until another PSROUT change card request is encountered in simulation time.

PSROUT requests are not additive. Each one effectively deletes all others with a FPAR time less than itself, i.e., they become effective at the time specified. Also, it is safest to specify a time a little previous to the first PSR to be affected.

One additional option to request all statistics after fewer statistics were requested during a simulation run, is accomplished by placing ALL * on the request card (i.e. card following the PSROUT change card).

c. Special Consideration

When users select some of the statistics such as the ones specifying % of time, these may not be too meaningful without their companion statistics.

18. Initial Class Assignment for Aircraft

The Input Module defines the initial class into which all aircraft are placed at the beginning of the simulation. This initial class will be the first class specified for the aircraft on Form 17 in the Mission Class/Configuration field (Col 22-27), i.e. the first Form 17 card specifying the aircraft.

The change card, STORAC, allows the user to redefine this initial class, thereby causing the aircraft to be placed into a different class than that predefined by the Input Module. Class numbers can be found in the Class Dictionary printed at the end of the input run (when input module spec option INFO=2 or 3 is selected).

Only aircraft present at the beginning of the simulation (time = 0) will be placed in this class. New aircraft generated during simulation will follow the aircraft generating procedure.

If this STORAC change card is not input, the aircraft will be assigned the predefined class.

The user cannot specify "available" or "cocked" within the class, the aircraft will automatically be placed in the "available" status of the initial class.

19. Aircraft Timing Switch -J, K, and U Selection Mode

This aircraft K selection mode timing switch, the KTIMSW controls the processing (or not processing)

of network tasks coded with a J or K selection mode.

The primary control of the setting and resetting of this switch is done by tasks coded with a K selection mode. A secondary control for resetting the switch is done by tasks coded with a U selection mode. The switch is a three position switch (off=0, partially on=1, fully on=2).

When the switch is off or partially on, both J and K selection mode tasks are processed. When fully on these tasks are skipped. The partially on condition permits users to process series of J mode tasks, even with intervening tasks using other selection modes. The J tasks will set the switch to partially on.

K tasks, however, will set the switch fully on, regardless of the switch condition, and trigger the simulation software to reset the switch to off after a specified time interval. This triggering of the reset is done at the beginning of the K task prior to processing it. The time interval is by aircraft type and defaults to 24 hours. However, the user may use the KTIMSW change card to input a new time interval.

If the user fails to control the switch with a K mode task, the simulation software will take some default actions at End-of-Network. End-of-Network (EON) is defined as the end of network processing, that is, the last task completion. This can occur at either; (1) true end-of-network, (2) at the sortie task for a spare aircraft, or (3) at the sortie task for an aircraft whose mission has already occurred or been canceled. If at least one J mode task was processed and the switch was partially on when reached, the switch would automatically be set fully on and the software triggered to reset the switch to off after the specified time interval. With the switch either fully on or off at EON, no action is taken.

The U selection mode is effective only if the switch is fully on and a reset of it has been triggered. The U selection mode will unschedule the switch's resetting and set it off immediately upon being processed. If the switch is off or partially on when the U selection mode is processed no action is taken. In all cases the task coded with the U mode will be processed as a do task.

Table 4-5 contains a total recap of all K time switch KTIMSW actions that can take place.

Table 4-5 KTIMSW ACTION MATRIX

Processing Location	Switch Value Current	Switch Value Changed to	Directed Action	Switch Reset
At J Task	0	1	Process J task	N/A
At J Task	1	1 NC	Process J task	N/A
At J Task	2	2 NC	Skip J task	N/A

At K Task	0	2	Process K task	Scheduled
At K Task	1	2	Process K task	Scheduled
At K Task	2	2 NC	Skip K task	N/A

At EON	0	0 NC	N/A	N/A
At EON	1	2	N/A	Scheduled
At EON	2	2 NC	N/A	N/A

At U Task	0	0 NC	Process U task	N/A
At U Task	1	1 NC	Process U task	N/A
At U Task	2	0	Process U task	Unscheduled

Note: NC = No change
N/A = Not applicable

The KTIMSW can be used in either pre- or post-sortie networks. However, there is only one (1) K timing switch per aircraft. Once the K mode task has been processed all subsequent J or K mode tasks in the network will not be processed unless the reset time interval has passed or a U selection mode task has been processed. Therefore, use of the feature in pre-sortie networks could negate post-sortie use.

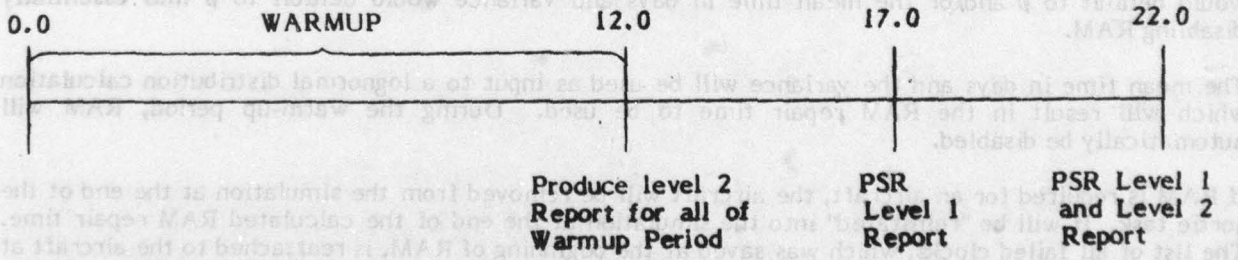
RAM aircraft are returned to the simulation with the switch turned off and no switch resetting scheduled. New aircraft enter the simulation in the same way.

20. Warm-up Period

The warm-up period is the period of time from the beginning of a simulation (time Ø.Ø) until a user defined integer number of days has been completed. The warm-up period is used to approach a steady state situation before statistical evaluation of the simulation is attempted. For example, at the beginning of the simulation, all aircraft are in the "beginning" configuration and there are no parts backordered. The simulation must be run for a period of time before the aircraft are dispersed into other configurations or assigned to network processing, and the parts are assigned to tasks and/or backordered. Once a reasonable steady state condition has been reached, any bias which could have been caused by the start-up of the simulation has been eliminated.

During the warm-up period, no intermediate Performance Summary Reports (PSR's) will be produced and no RAM repair or attrition will occur. The RAM repairs and attritions will not occur so that at the end of the warm-up period, the simulation will have the correct number of aircraft to begin the statistically supported segment of the simulation. However, statistics will be accumulated during the warm-up period. At the end of the warm-up period, a level 2 PSR is produced and the level 1 and level 2 totals are zeroed. This level 2 report allows the user to collect statistics on the warm-up period only. It is normally only used for debug purposes.

The WARMUP change card is used to define the length of the warm-up period. When this change card is encountered, the first PSR is scheduled for the end of the warm-up period. This first PSR will produce a level 2 report which encompasses the whole warm-up period regardless of the values of change card RFREQ and RCYC. Then RFREQ and RCYC have the end of the warm-up period as their reference point. For example, if the warm-up period is for 12 days and RFREQ is defined equal to 5 and RCYC is defined equal to 2, the following will occur:



The WARMUP change card can only be input at time Ø.Ø. The warm-up period will be assumed to end at time Ø.Ø if no WARMUP change card is used. The first PSR will occur at the end of the warm-up period unless the warm-up period is of Ø length. Data being sent to post-processors (matrix, parts, RFS, etc.) includes the warm-up period if requested.

21. ATTRITION - See RAM/ATTRITION/AIR ABORT Relationship.

This option allows the user to delete or remove aircraft from the simulation based on an attrition percentage. To activate this feature, use the PRBATT change card to set attrition by mission type. The attrition percentage is the percent of aircraft which will be removed by attrition of all aircraft which fly and do not air abort. Conditional probabilities must be considered here by the user. See the relational write-up concerning RAM/Attrition/Air Aborts. If no attrition percentage is defined for a mission type, it is assumed to be 0%. If a percentage is input, it is an integer value between 1 and 100 inclusive.

Based on the mission type and the attrition percentage, the LCOM II will internally determine when attrition will occur and remove the aircraft from the simulation. The number of possessed aircraft will be decremented by 1 in this case. The PRBATT change card can only be input at time Ø.Ø. Attrition will be disabled during the warm-up period. In LCOM II, aircraft are removed by attrition after the sortie task and therefore all flying hours will be accounted for. When attrition occurs, the sortie length can be reduced by a percentage defined on the ATTPCT change card.

The decrease percentage is defined by aircraft type. The decrease percentage must be an integer number between 1 and 100. One possible user requirement that currently cannot be handled by the attrition option is to replenish at some time in the future. This can be handled by turning off the attrition option (0%), creating an attrition network controlled by "E" selection modes, consuming the aircraft, accomplishing a task whose length equals the time to wait before replenishing and then generating the aircraft again. The newly generated aircraft will be placed in the "standard" configuration. However, no attrition statistics are collected. Use the hit matrix to determine the number of attritions.

22. RAM Repair - See RAM/ATTRITION/AIR ABORT Relationship

An aircraft which returns from a sortie may, because of extensive damage, be repaired by a special team whose personnel are not part of the local manning. This is called Rapid Area Maintenance (RAM). In LCOM II, the PRBRAM change card will be used to define the probability of RAM repair percentage by mission type. The RAM percentage is an integer value between 1 and 100 inclusive. Also required is a RAM repair time in terms of a mean and a variance value defined by aircraft type on the RAMTME change card.

Should these change cards not be defined for certain missions and/or aircraft types, the percentage would default to Ø and/or the mean time in days and variance would default to Ø thus essentially disabling RAM.

The mean time in days and the variance will be used as input to a lognormal distribution calculation which will result in the RAM repair time to be used. During the warm-up period, RAM will automatically be disabled.

If RAM is required for an aircraft, the aircraft will be removed from the simulation at the end of the sortie task. It will be "reinstated" into the simulation at the end of the calculated RAM repair time. The list of all failed clocks, which was saved at the beginning of RAM, is reattached to the aircraft at this time. The aircraft then will go to the node immediately following the sortie task as defined by the user. At this point, the aircraft is considered in post-sortie processing. Aircraft post-sortie turnaround time is calculated from this point to the end of the network. The RAM repair time is not included in the turnaround statistic.

The RAM percentage is only applied against those aircraft which the model has determined actually fly and do not air abort or disappear through attrition. Read the RAM/Attrition/Air Abort relationship described later.

Because of the method used to simulate RAM (temporarily removing and then regenerating the aircraft), there can never be any resources used or consumed during the RAM repair period. When an aircraft returns from RAM, its configuration remains the same as the configuration it was in when it landed after the sortie.

23. AIR ABORTS/SYMPATHETIC ABORTS - See RAM/ATTRITION/AIR ABORT Relationship

This option gives the user the capability to have air aborts occur. The AABORT change card is used to input all the air abort data specifications. The user specifies on this change card a percent factor by mission type which will control the frequency of the air aborts. An air abort sortie length is specified on the AABORT change card as a decrease percentage where, for example, a value of 50 would indicate the scheduled sortie length is to be decreased by 50%. This decrease percentage is specified by mission type on this change card.

When an aircraft is air aborted, upon landing it begins processing through its post-sortie processing networks. However, the configuration of the aircraft will be that which is specified on the AABORT change card. Also the user may want special processing to occur immediately after the sortie. The next node after the sortie can be altered when an air abort or sympathetic air abort occurs by specifying the control table index on the AABORT change card. This value is obtained fom the control table printout from the Input Module run. This index is specified by mission type.

Sympathetic air aborts are handled exactly the same as air aborts. A matrix containing the number of sympathetic air aborts required, based on the number of aircraft flying for the mission and the number of aircraft which air aborted, is used to determine the aircraft which will sympatheticly air abort. This matrix is "hardwired" into the Main Module and can only be altered by recompiling. The matrix is shown in figure 4-12. Sympathetic air aborts cannot occur for missions which have more than 6 aircraft flying.

		NBR AIR ABORTS					
		1	2	3	4	5	6
NBR	1	0					
A/C	2	1	0				
FLYING	3	0	1	0	----------Hardwired NBR Sympathetic Air Aborts		
	4	1	0	1	0		
	5	1	0	1	1	0	
	6	1	0	1	0	1	0

FIGURE 4-12. AIR ABORT MATRIX

24. RAM/ATTRITION/AIR ABORT RELATIONSHIP

An aircraft cannot have more than one of these three conditions occur on a specific mission. The Main Module internally determines, using the user input percentages, if one of these conditions occurs. The determination is made just prior to the sortie.

First, a determination is made if an air abort will occur. If so, the aircraft is flagged to have the air abort occur after the sortie and the sortie length is shortened. Then aircraft which will sympatheticly abort are also flagged. Finally, for all aircraft which will fly but are not flagged to abort, the aircraft selected for RAM and attrition are flagged. Those selected to be removed by attrition are flagged first and from the remaining unflagged flying aircraft, those which are to go to RAM are picked. With this scheme, no aircraft can have more than one of the above conditions occur during the same mission.

Once the sortie is completed, a check is made for a flag attached to the aircraft. If attrition is to occur, the aircraft is removed from the simulation. If RAM repair is required, the aircraft is temporarily removed from the simulation. Obviously air aborts and attrition occur during a sortie, but for simulation purposes checking for these occurrences before the sortie and shortening the sortie length as appropriate does not affect the simulation results.

The attrition statistic in the main Performance Summary Report is updated just prior to the sortie when the flag check was made. It cannot be updated after the sortie because mission information is not available. The number of RAM repairs and air aborts are also updated just prior to the sortie. Note that the air aborts and sympathetic air aborts are in the air abort total.

25. TASK SUBSTITUTION

If the user needs to replace one task with another, for example, for thru-flight and post-flight tasks, the TSUB and TSUB1 change cards will be used to define the task ID of the task which will be replaced and a task ID of the task which will be substituted. Also defined on these change cards is the time during the day when the replacement will occur and when the tasks which were replaced are reset to their original task ID. Only those replaced will be reset. This means that if task A was to replace task B, and task B was specified twice in the networks, and task A was specified four times in the networks; then the two B tasks would be replaced with A tasks. Also, only these two A tasks would be later reset to B tasks again. The original four A tasks would not be reset to B tasks.

For the TSUB change card the reset time is assumed to be within the same day as the replacement time and also later in the day. The replacement and reset times are input as decimal hours (11.0 is eleven o'clock; 13.5 is one thirty). Only tasks of the same type may be substituted for each other, and neither a sortie task nor the dummy task can be used. No sortie tasks can be substituted and the dummy task cannot be used for substitution. This substitution takes place on a daily basis and occurs throughout simulation.

For the TSUB1 change card the replacement time and reset time is specified in decimal days, indicating the particular days task substitutions are to take place. There is no cycling of the substitutions, one TSUB1 card specifies one replacement and one reset. If the reset field on the TSUB1 card is blank or zero then no reset will occur.

26. FCF Task Collection

A Functional Check Flight (FCF) task can be defined using the FCFTSK change card. This permits a collection of the number of times the FCF task is processed; this number is printed in the main Performance Summary Report. If a FCF task is defined, its task ID will be found in the task dictionary. If it is not defined, no FCF statistics will be accumulated.

27. TACMOD Feature - Weather, Alert, and Mission tapering

The weather delays, weather cancels, alert replenishment, alert release, and mission tapering features all require special input data in columns 74 thru 80 on the Form 20s. These features collectively are called the TACMOD features because they were designed to integrate with a TAC program called CREAT20 which mechanically provided the Form 20s with the additional data. These features require the use of special flags in both the input and main modules to activate the necessary logic and accept the additional flying program data. Users other than TAC can use these features by manually adding the additional data or by obtaining the necessary programs from TAC.

Data in Columns 1-73 on Form 20 remains standard, therefore, users desiring to use these features are only required to add the proper information in Columns 74-80. When the extra data is present Column 2 of the Form 20 control card (which contains the word LIST and the keyword) must be a "T", i.e., LIST becomes LTST. Also, to cause the Main Module to use the additional data, the TACMOD change card is required. This change card must precede the use of any additional change cards required to operate the specific TACMOD features.

The additional data is described thus. Column 74 will contain a data type indicator where: Ø=normal frag (Form 20), 1=weather delay, 2=weather cancel, and 3=alert replenishment or alert release. Columns 75-76 contain the mission tapering value. Columns 77-80 contain the weather delay time in minutes. Since users of these TAC options will use Columns 74-80, it is illegal to use the "T" distribution or sequence numbers on Form 20s.

Alert missions will be handled in LCOM II in the same manner as any other mission. Alert replenishments and releases, however, are different in that activities must be used. When the aircraft completes this activity processing, it is released as a cocked aircraft. This is different from all other aircraft activity processing in that aircraft are normally released as available aircraft. The activities must be defined on the Form 17. All Alert statistics are calculated and reported in the designated alert mission report column.

Weather delays will be handled in LCOM II in the same manner as any other mission. However, weather cancels will process through a weather cancel activity network. Because of this, a weather activity is required on the Form 17 for each mission which may have weather cancels.

Users of the TAC options must use the Input Module to create their exogenous file. This will allow more edits and make available more options as well as standardizing the exogenous file creation.

One piece of information that is not available to the LCOM II input module is an Activity report column. Therefore, the weather cancel report column is input by means of the WCXCOL change card and the alert replenishment report column and the alert release report columns are input by means of ALTCOL change cards. Activities, when defined on the Form 17 do not have a specific report column defined, thereby requiring these change cards.

Mission tapering is an automatic non-scheduling of missions when attrition and RAM have reduced the number of possessed aircraft below a user defined number. Columns 75-76 of the Form 2Ø contain this value that specifies the number of available aircraft at and below which the mission tapering becomes effective for this mission. In other words, this mission is not scheduled if the current number of available AC is too low. The original number of aircraft must have been deleted from the simulation to this value either permanently, by attrition, or temporarily through RAM. Mission tapering can be used to keep the scheduled sortie rate constant rather than allowing it to increase as aircraft are removed from the simulation.

Statistics are collected in the main Performance Summary Report for the weather cancels, weather delays, alert replenishments and alert releases. Values will be zero unless these features are activated, and report columns specified. These statistics are updated at frag time when the request is initially read.

The TAC unique CREATE2Ø documentation should be read for more detailed information concerning the creation of weather delay, weather cancel, alert, alert replenishment, alert release, and mission tapering data.

28. SECIN (Change Card Reading) Scheduling

The reading of the change cards provides a user with a secondary initialization step, SECIN, accomplished subsequent to the reading of the initialization file produced by the input module. This permits small changes to be made prior to the simulation and prevents the need to continually rerun the input phase.

This SECIN is scheduled automatically at time=0.0, just prior to starting the simulation. Scheduling the input of change cards at other than time=0.0 is accomplished by using a SECIN change card within the initial set of change cards. The time is input in integer days. One or more SECIN cards can be input at time = 0.0 or at any subsequent SECIN read-in time. See figure 4-13.

For each SECIN card used, an additional change card file is required with the same rules for applying to each one as applied to the first set. In addition any change card with a time value on it, such as a report request, must not have this value less than the time of the scheduled SECIN reading the card. An abort will occur, i.e., simulation time decreases. Also some change cards are not applicable at a time other than 0.0. Some edits are performed but common sense should prevail. Remember each set of change cards must end with a STOP change card. However, scheduled SECIN readings of this card always ignore this time.

Interfacing this SECIN scheduling feature and the Memory Dump and Restart feature can be done by properly integrating the sets of change cards.

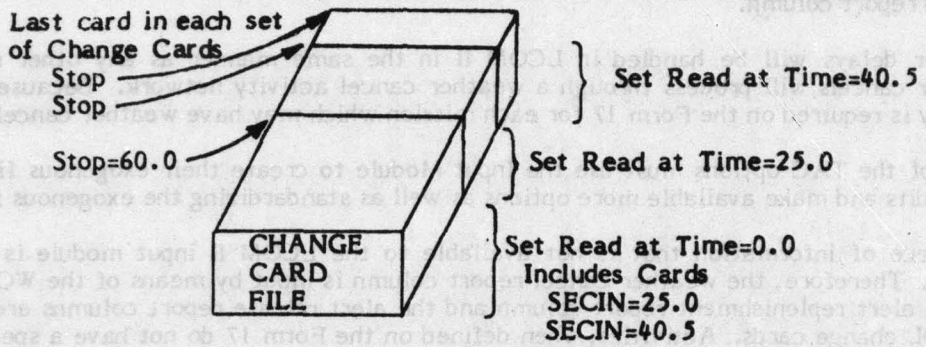


FIGURE 4-13. EXAMPLE USE OF SECIN SCHEDULING

29. FACTOR - Form 12 Quantity Fields Interpreted as %

Form 12 quantities fields (Col 44-45, 53-54, 62-63) specify the exact quantity of a particular resource that is required on the task. However, there is a feature which permits the interpretation of quantity fields as a percent (%) of time a quantity of one is required. For example, if the value of the term FACTOR = 20, then any quantity on the form 12's greater than or equal to 20 will be interpreted as a percentage of time. IF a task specifies resource N, quantity of 20, it will be interpreted as: 20% of the time the task is done, a quantity of 1 of the resource N is needed. The remaining 80% of the time a quantity of zero is needed.

Therefore, when resetting the default value of FACTOR (100), it must be remembered that any Form 12 resource quantities greater than or equal to the FACTOR value will be interpreted as percentages. The term FACTOR is modified by the change card of the same name.

30. A, E, and G Selection Mode Relationships

This section provides a comparison of the A, E, and G selection modes. These selection modes provide a multitude of possibilities for modeling network branching. The description here can obviously not be all inclusive. As additional methods became popular or new information becomes available, the section will be updated. Several methods are presently under consideration which when thoroughly tested could be added here. The information presently included is believed to be accurate but not all inclusive. User comments are solicited.

a. Statistical Comparison of A and G Selection Mode

The A selection mode provides a method for networking the situation where one or more non-mutually exclusive paths are to be selected. The G selection mode (used together with an E selection mode) provides an additional option for this purpose. The example below will provide some guidance as to which mode should be used for a specific case.

The reader should note that when the total in-shop failures are less than the total on-equipment failures, the two methods provide the same number of hits against each shop task, thus they are equivalent. The A selection mode provides more instances of no shop work and more instances of multiple in-shop hits than does the G with E network, thus they are not equal.

Hypothetical Example #1: Suppose we have data from 100,000 sorties which shows 5000 on equipment failures (hits) in the 41AB* work unit code area. Suppose also that the In-shop data shows 700 hits against 41ABA, 600 hits against 41ABB, 500 hits against 41ABC and no hits against any other items. In networking this subsystem A or G with E selection modes can be used to determine when to go into the shop and what is worked on. Figures 4-14 and 4-15 illustrate networks for these two approaches. Table 4-6 compares the two approaches as the number of on equipment hits varied from 2000 to 20,000.

It is important to note that in a simulation, the same number of on equipment actions would occur when using either the A or the G selection modes. Similarly, in the shop the same number of actions would be performed against each end item. The major difference between the two methodologies is as noted earlier in the number of times no shop work is performed and in the number of times more than one shop task is performed. There are two assumptions implicit in the use of the G selection mode. All items entering the shop for repair are assumed to fail independently of one another and the time between shop repairs for each item is either geometrically or exponentially distributed. Many studies have shown that the failure law of most items can be closely approximated by the exponential distribution and the geometric is simply the discrete analog of the exponential.

To use the G selection mode, the on aircraft portion of the network must be expanded as in Figure 4-14. The task named E41AB* in Figure 4-15 which represents all on aircraft work is replaced by the two tasks M41AB* and R41AB*. Task M41AB* represents work that is performed on aircraft when no shop work follows. This is generally minor maintenance type work. Task R41AB* represents work that is performed on aircraft when shop work follows. The E selection mode probability (E_R) for task R41AB* is computed as follows:

Let P_i = Number of shop hits on the Ith item divided by the number of sorties in the data bank.

Let H = The number of on-aircraft hits.

Let S = The number of sorties in the data package.

Let P = The product of $(1-P_1)(1-P_2)\ldots$

Then $E_R = \frac{(1-P)\,S}{H}$ and $E_M = 1-E_R$

Usually this is a quick calculation because few items are involved. This calculation determines the correct number of times the model should enter the shop. In our example above and using the fourth line in Table 4-6 (5,000 on aircraft hits), this calculation would be:

$$P_1\ (41ABA) = \frac{700}{100,000};\quad P_2\ (41ABB) = \frac{600}{100,000};\quad P_3\ (41ABC) = \frac{500}{100,000}$$

$$P_1 = .007 \qquad P_2 = .006 \qquad P_3 = .005$$

$$P_I = (1-P_1)\ (1-P_2)\ (1-P_3) = .993 \times .994 \times .995 = .982$$

$$E_R = \frac{(1-.982)\ 100,000}{5,000} = .36, \text{ and } E_M = 1 - .36 = .64$$

From Table 4-6, it can be seen that as the ratio of total off-equipment hits to total on-equipment hits decreases, the A selection mode approaches the G selection mode in results, i.e., the percent fewer shop entries decreases from 27% to 2%.

The G selection mode has one major drawback. The G selection mode probability is equal to P_i for the Ith item. This usually is a very small number. When the model encounters a node with G selection modes, it treats them the same as the A selection modes in choosing which path or paths to follow, except, if no path is chosen, then the model will loop back and try again and will continue looping until at least one path is chosen. It is this looping which increases computer processing time and it can be significant if the probabilities are small.

As can be seen by comparing Figure 4-15 where the A selection mode is utilized with Figure 4-14 where the G mode is used, there is very little difference in the networking technique. Some of the prime factors in deciding whether to use the G vs A selection modes are: (1) How sensitive is the final answer to be derived, to the "independence" of failures? If very sensitive, use the G. (2) What is the ratio of shop actions to total on aircraft actions? As demonstrated in Table 4-6 as the ratio decreases from .9, i.e., (1,800/2,000) in line one to .09 (1,800/20,000) in the last line, the A mode approaches the G. (3) How critical is computer run time? Extensive use of the G selection mode can increase run time by 15 percent, or more; however, if the desired answer is sensitive to precise statistical treatment of the independence of failures then the price is worth the cost. The graph in Figure 4-16 illustrates the reason for increased computer time with increase in E_R, and reflects a plot of the last column in Table 4-6.

TABLE 4-6. A/G SELECTION MODE COMPARISON

Total On A/C Hits	E_R	F Clock Value	Numbers of On A/C Hits That Are Not Followed By Shop Work		Numbers of On A/C Hits That Are Followed By Instances of Shop Work		% Fewer Shop Entries With A	# Draws Required Per Cycle		G/A Draw Ratio
			With A	With G	With A	With G		A	G	
2000	.895	50.0	682	210	1318	1790	27	3	50.67	16.56
3000	.597	33.3	1533	1210	1467	1790	18	3	34.13	11.38
4000	.448	25.0	2454	2210	1546	1790	14	3	25.86	8.62
5000	.358	20.0	3406	3210	1594	1790	11	3	20.87	6.96
7000	.256	14.3	5349	5210	1651	1790	8	3	15.21	5.07
10000	.179	10.0	8305	8210	1695	1790	5	3	10.93	3.64
20000	.090	5.0	18253	18210	1747	1790	2	3	5.97	1.99

Notes:
1. Shop actions held constant at 1800, (700 + 600 + 500).
2. E_R is the probability of doing off-equipment work, given that a failure has occurred on that system.
3. The word draw refers to the selection of a random number by the model.

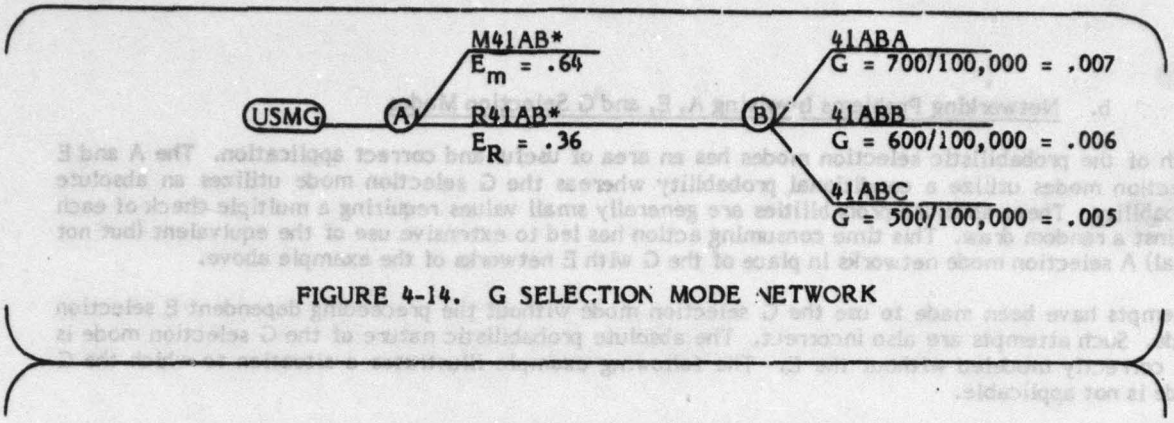


FIGURE 4-14. G SELECTION MODE NETWORK

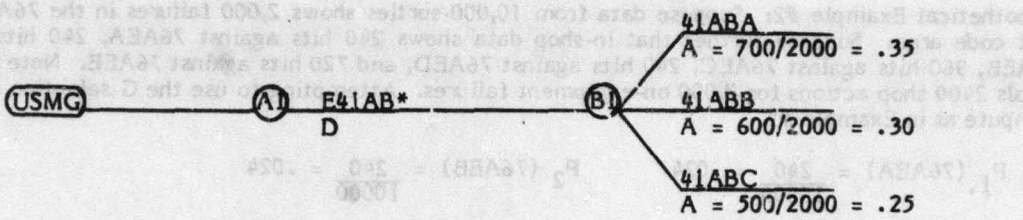
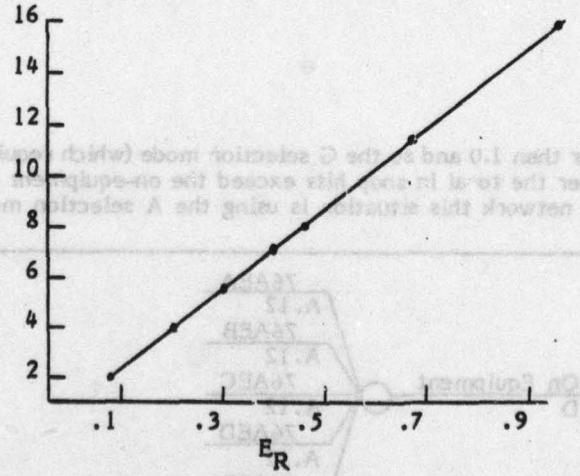


FIGURE 4-15. A SELECTION MODE NETWORK

RATIO OF THE NUMBER OF RANDOM DRAWS REQUIRED
(G SELECTION MODE/A SELECTION MODE)



Note: Graph plotted from Table 4-6where shop actions were held constant at 1800, as per the hypothetical example, while the number of on-equipment hits was increased from 2,000 to 20,000.

FIGURE 4-16. G/A SELECTION MODE - DRAW RATIO GRAPH

b. Networking Problems Involving A, E, and G Selection Modes

Each of the probabilistic selection modes has an area of useful and correct application. The A and E selection modes utilize a conditional probability whereas the G selection mode utilizes an absolute probability. These absolute probabilities are generally small values requiring a multiple check of each against a random draw. This time consuming action has led to extensive use of the equivalent (but not equal) A selection mode networks in place of the G with E networks of the example above.

Attempts have been made to use the G selection mode without the preceeding dependent E selection mode. Such attempts are also incorrect. The absolute probabilistic nature of the G selection mode is not correctly modeled without the E. The following example illustrates a situation to which the G mode is not applicable.

Hypothetical Example #2: Suppose data from 10,000 sorties shows 2,000 failures in the 76AE* work unit code area. Suppose further that in-shop data shows 240 hits against 76AEA, 240 hits against 76AEB, 960 hits against 76AEC, 240 hits against 76AED, and 720 hits against 76AEE. Note that this totals 2400 shop actions for 2,000 on-equipment failures. Attempting to use the G selection mode we compute as in Example #1.

$$P_1\ (76AEA) = \frac{240}{10000} = .024 \qquad P_2\ (76AEB) = \frac{240}{10000} = .024$$

$$P_3\ (76AEC) = \frac{960}{10000} = .096 \qquad P_4\ (76AED) = \frac{240}{10000} = .024$$

$$P_5\ (76AEE) = \frac{720}{10000} = .072$$

$$P_1 = (1-P_1)\ (1-P_2)\ (1-P_3)\ (1-P_3)\ (1-P_4)\ (1-P_5)$$

$$= (.976)\ (.976)\ (.904)\ (.976)\ (.928)$$

$$= .7799$$

$$ER = \frac{(1.-.7799)\ 10000}{2000} = 1.10$$

But we cannot have E probabilities greater than 1.0 and so the G selection mode (which requires an E) cannot be used. This will happen whenever the total in shop hits exceed the on-equipment hits by a significant amount. The obvious way to network this situation is using the A selection mode as is shown in Figure 4-17.

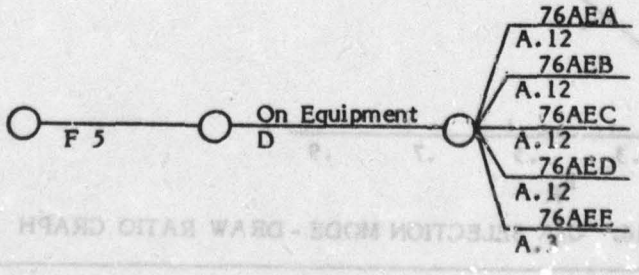


FIGURE 4-17. A SELECTION MODE METHOD

The weakness in this method is again that the probability that no shop will be done is significant. Here it is .2268. Some users desire more balanced shop utilization and thus model the entry to shop work as an A in parallel to a D selection mode. This is shown in Figure 4-18. This method then uses E selection mode for the in-shop branches.

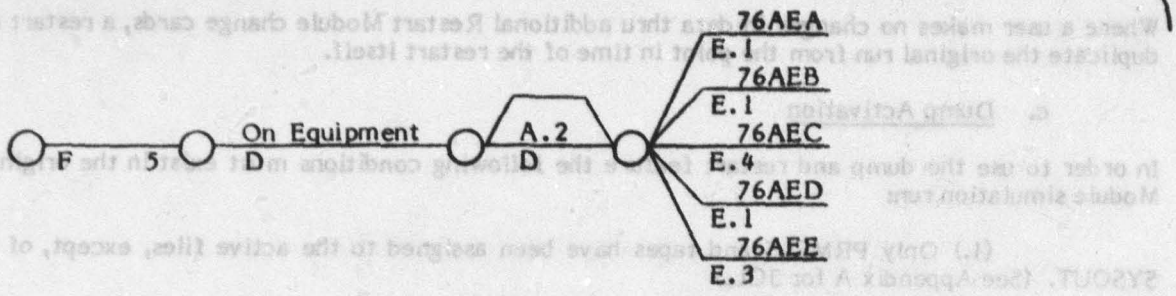


FIGURE 4-18. A AND D WITH E SELECTION MODE METHOD

The A and E with E selection mode method insures that either 1 or 2 shop tasks follow each on-equipment action. This approximates but does not emulate the A selection mode method since now either 1 or 2 but not 0, 3, 4, or 5 paths may be taken.

For further information on the G selection mode refer to the AFMSMET Publication 78-2 titled "The G Selection Mode, Its Independent and Dependent Use", 1 June 1978.

31. Dump and Restart

The DUMP and RESTART feature is applicable only to the HIS LCOM II computer implementation, since the CDC and IBM SIMSCRIPT II.5 compilers do not contain this capability.

a. Basic Terms

The term DUMP refers to the capability of dumping onto a tape the entire memory allocated to an LCOM II run at specific times during its execution. Included in this memory allocation are all the necessary pointers to the files assigned and opened.

The term RESTART refers to the capability to restore from a tape (prepared with the DUMP feature) the entire contents of memory at the point in time the dump was taken, and return to a fixed point in memory which will cause a restart of the simulation. Included in this is the complete repositioning of all files except for SYSOUT prior to restarting. Because of the need to reposition all files opened, only tapes and/or PRMFLs should be used. See also last para in this description.

b. Concepts

An LCOM II simulation is a time oriented, incrementally processed set of events. At periodic intervals of time the computer software can be triggered to make a snapshot copy (DUMP) on tape of the entire memory allocated to the simulation. The feature in LCOM II permits a sequential set of these memory dumps to be taken. For example, at the end of every 5 days (of simulation) a separate dump (checkpoint) can be taken, so that on a dump tape, there would be 5 separate dump files for 25 days of simulation.

A user desiring to restart the simulation at any of these checkpoints may do so by executing the Restart Module designed to read a specific checkpoint from the tape, and cause a restart of the simulation. Although this restart program itself is small, the same amount of memory allocated to the original simulation must be given to this program so that it can reload the checkpoint dumps into memory.

Where a user makes no changes in data thru additional Restart Module change cards, a restart run will duplicate the original run from the point in time of the restart itself.

c. Dump Activation

In order to use the dump and restart feature the following conditions must exist in the original Main Module simulation run:

(1.) Only PRMFLS and tapes have been assigned to the active files, except, of course, SYSOUT. (See Appendix A for JCL.)

(2.) The "DUMP" SPEC card option must be used and it must specify a unit upon which the dumps are to be taken.

(3.) A dump tape must be assigned to the specified unit.

(4.) The simulation interval between taking dumps must be specified using the RECRD change card unless the default 5 day interval is acceptable. (See CHANGE card write-up)

d. Restart Activation

To restart the simulation, the following must exist in the Restart Module run:

(1.) The exact same PRMFLs and tapes (including the Dump tape) used on the original run must be assigned. (See Appendix A for JCL.)

(2.) The exact same memory size must be allocated. (See also last para in this description.)

(3.) The CHANGE cards for the original run must be present and followed by at least a second STOP card to control the stop time for the restarted simulation. As implied here, a new (add-on) CHANGE card file is read by the Restart Module upon restart; therefore, new change cards can be used to affect the results of the restarted simulation. They would be placed between the original stop card and the restart program stop card.

(4.) The Restart Module through its SPEC card must be told the tape unit from which the Dump tape will be read and the specific sequential dump checkpoint to read prior to restart. This tape must be assigned to the same unit as it was in the original run.

e. Special Considerations

Although stated earlier, that only tapes or PRMFLs should be used, an input $:DATA file is for all practical purposes a permanent file. This is due to the loading of this file at job read-in time, either by the individual records following the $:DATA card, or the use of $:SELECT:XXX or $:SELECTA:XXX JCL to load in some specific data. However, all data on this file for the original simulation must be present. Additional data can be on this file.

The Restart Module, if not told the restore tape unit (REST), will assume unit 8 as its input.

The Restart Module, if not told the checkpoint number (CHCK) to read, will assume the first dump is to be read.

The time on the Restart Module STOP change card (second stop card is for the first restart) will override the original STOP card time. For example; the original simulation run was for 40 days with dumps at five day intervals, by restarting with the 4th checkpoint (day 20) and using a STOP card of 60, the restart should run from day 20 to 60.

The RECRD change card can also be used to control the length of simulation by specifying the number of additional dumps during the restarted simulation. For example, in restarting the above original case, a RECRD card indicating 8 dumps at a 5 (five) day interval, would cause the same restart run of 20-60 days. If RECRD is used in this manner, the simulation will end at the last requested dump before the STOP card time if the STOP card time is greater than the dump interval. However, if the interval time on the RECRD card exceeds the STOP card time, the simulation will run for the full amount of time specified on the RECRD card.

Use of the RECRD option on either the original or restarted runs permits the changing of the dump interval. It cannot eliminate dumps from being taken, once set up by the use of the DUMP spec card on the original run.

Those not desiring to use Dump and Restart should not use the DUMP spec card option.

Sometimes the original run requires additional memory to complete, for example, started with 90K but added 10 extra pages (10K) during its entire simulation. When restarting this run, there is no way of knowing the exact allocation of memory at the point of a checkpoint dump (except the last one). If a restart is attempted with the same limits as the original run and the original run had grown in memory requirements at the point of restart, the restart run will abort with a FØ memory address fault. No other indication of the problem will be given. Therefore, use the maximum memory allocated at the end of the original run. Some unused memory may exist using this technique, but is not harmful. Using the example, restart any checkpoint with an allocation of 100K.

32. Resource Substitution (Generalized and Task Specific)

a. General Description

Resource substitution can be specified in two ways with LCOM II; (1) as a general resource substitution case where one resource can substitute for another, or (2) as a task specific substitution where a resource or group of resources can substitute for another resource or group of resources.

The general substitution can be applied to all types of resources, whereas, the task specific substitution applies only to manpower resources. These two types of resource substitution can be used independently of each other or together. Form 13 must precede Form 12 if Form 12A's (task specific resource substitution) are used.

Each substitute or group of substitutes is considered of equal ability in terms of task performance, i.e., task time distribution, and priority.

The user may turn task specific resource substitution (Form 12A's) completely off in a simulation run even if task dependent substitute crews have been defined. This is accomplished by placing a NOPOMO change card in the change card deck. LCOM II will automatically pass the original crew to the task starting mechanism and ignore substitute crews. Note that the NOPOMO card does not affect general resource substitution of the prime resources.

b. General

General resource substitution is specified on Form 13 along with the resource definition. Form 13 has additional data fields to permit defining up to four substitutions on a single Form 13 record. Also, Form 13 continuation cards can be used, thereby, permitting an unlimited number of substitute

resources to be specified. Substitutes are, however, placed on the form in the order of preference. When processing these substitutions during simulation, the process will,when the original resource is not available, attempt to use the first substitute, then second, third. . . last one specified. Controlling the use of these general substitutions will be discussed later.

See Chapter VIII, Section C, for a description of the Form 13 data preparation which includes these generalized resource substitution fields.

c. Task Specific

Where general resource substitution is not adequate, LCOM II permits substitutions to be defined on a task by task basis. On Form 12, after the task has been defined and its manpower and non-manpower resources specified, the user can, by using a Form 12A, specify an entirely new manpower crew reflecting any necessary substitution.

Form 12A is not a new form but is only a modification of Form 12 and serves as a specialized continuation record to further define the tasks in terms of the task specific crew substitutions. As such, only manpower resources can be specified on Form 12A. Any non-manpower resources must have been specified on the original Form 12 record for the task, but will automatically be carried over into the task's resource requirements lists along with the alternate crew.

Form 12A also modifies the meaning of three of the Form 12 fields thus: (1) The associated resource field (Col 30-35) can optionally be used to specify the name of a Resource Combination Set (RCS) of substitute resources for reuse in other 12A records; (2) The consume fields (Cols 43, 52, and 61) are used on Form 12A to activate general resource substitution; and (3) Column 36 can be used to control the order of use of the Form 12A records.

See Chapter VIII, Section B for a complete description of the Form 12 and 12A data preparation.

d. Resource Substitution Example

Figure 4-19 illustrates use of Form 13 and 12/12A for the following rather complicated Resource Substitution example.

(1) A troubleshoot task on the flight controls is normally done by a team of two 325X0 autopilot specialists, one 431C1 aero repair team chief, and one 423X4 hydraulic specialist. They use a D60 power unit, hydraulic mule, and B4 stand. These requirements are listed on a basic 12 card with continuation.

(2) Since one of the autopilot specialists merely observes control surface movement, he may be replaced by a 431X1 general mechanic for this task. This is indicated on a Form 12A which specifies this Resource Combination Set as #1 (RCS1). The other 325X0 performs the autopilot checks and is always required.

(3) Each electrical (423X0), hydraulics (423X4), ECS (423X1), and engine (426X2) specialist is qualified as a general substitute for the 431X1, as indicated on the 13 card defining the 431X1 resource. Col 43 is marked on the 12A card to indicate that these may be alternate substitutes for a 431X1 general mechanic on this task.

(4) The ECS specialist (423X1) may also substitute for the hydraulics specialist (423X4) on this task, but not in general. This is listed on the second (RCS2) and third (RCS3) set of Forms 12A. (If 423X1 was a general substitute for 423X4, it would be listed as a substitute resource on the 423X4 Form 13 record. Block 61 would be marked on the T14COO Form 12, and the second and third Form 12A would not be necessary.)

(5) The first time a specific Resource Combination Set (RCS) appears in the data base, the resources are listed in full. For each subsequent use, resources would not require redefinition. See task T42XOO's Form 12A where RCS1 specifies the same RCS specified on task T14COO.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 13 - RESOURCE DEFINITIONS

CARD I.D.	RESOURCE I.D.	ENTRY	RES. TYPE	REPORT COLUMN	UNIT COST	AUTH. QTY	SUBSTITUTE RESOURCE	FAILURE RATE MEAN	FAILURE RATE VARIANCE	FAILURE RATE DIST	SUBSTITUTE RESOURCE	SUBSTITUTE RESOURCE	SUBSTITUTE RESOURCE
13	325XØ		M	1									
	431C1		M	2									
	423X4		M	3									
	423X1		M	4									
	423XØ		M	5									
	426X2		M	6									
	431X1		M	7			423XØ				423X4	423X1	426X2
	D6Ø		A	1									
	MULE		A	2									
	BA		A	3									

RESOURCE TYPE: I = Aircraft, P = Parts, M = Men, A = AGE, or Facilities
An * indicates resource can enter network.
Triangular distribution not allowed on this form.
Applicable to Model Version 3.0.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

CARD I.D.	Blank or A	TASK I.D.	Cont "C"	Task Type	Priority	TASK DURATION MEAN (OPTIM)	TASK DURATION VARIANCE (LIKELY)	TASK DURATION DIST	*	ASSOCIATED RESOURCE/ RCS	TASK RESOURCE REQUIREMENTS RESOURCE	C	QTY.	RESOURCE	C	QTY.	RESOURCE	C	QTY.	TRIANGULAR DISTRIBUTION (PESSIM)
12		T14CØØ		21		1.5H	.5M	L			325XØ		2	431C1			423X4		1	
		T14CØØC									D6Ø		1			B4	1 MULE		1	
	A	T14CØØ								RCS1	325XØ		1	431C1			423X4		1	
	A	T14CØØC									431X1	X	1							
	A	T14CØØ								RCS2	325XØ		1	431C1			423X1		1	
	A	T14CØØC									431X1	X	1							
	A	T14CØØ								RCS3	325XØ		2	431C1			423X1		1	
		T42XØØ		21		2.ØH	.5ML				325XØ		2	431C1			423X4		1	
	A	T42XØØ								RCS1										

TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only, 6 = Condemned, 7 = First base repair (treated as unscheduled.)
For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.
Applicable to Model Version 3.0.
Resource Combination Set (Form 12A)

FIGURE 4-19. RESOURCE SUBSTITUTION EXAMPLE.

e. Input Module Edits

The input module reorders the resource inputs entered on each 12/12A record such that the same combination of task resources are always stored in the same order. Support equipment and parts are ordered ahead of manpower. Any redundant definitions of Resource Combination Sets are flagged, eliminated, and replaced with the Resource Combination Set's name used in the first place the unique combination appeared.

Circular substitution, is a condition on a particular Form 12/12A where the use of general substitution would result in requesting resources already considered. These circular substitutions when defined are flagged by an edit in the input module (MSG 140). See error write-up for more explanation.

General resource substitution considers only those resources listed as substitutes on the Form 13 for the resource being substituted for, and then only when controlled by the X in Col 43, 52, or 61.

f. Main Module Processing

(1) Task Start Procedure

The main module attempts an on-hand balance scan for available resources before formal starting of each task. This is accomplished by examining the on-hand balance for the primary resources listed on the basic Form 12 for the task. If it is unable to start because one or more of these primary resources is not available, it examines the on-hand balance of substitutes in the following order:

(a) If general substitution activated for that resource, any applicable parts and/or support equipment substitutes listed on 13 records.

(b) If Col 43, 52, or 61 is marked on the Form 12, examine any applicable manpower substitutes in the order listed on the Form 13 records, treating as not available those resources that duplicate resources already considered.

(c) If unable to start because of parts or support equipment, attempt to preempt (see below).

(d) If unable to start because of manpower resources, examine the entire set of manpower resources that are listed on the next 12A record(s) for the task. This set would then replace the entire set of manpower resources listed on the base Form(s) 12 for the task, but retain the parts and support equipment conclusions reached in Step (a) above.

(e) If Col 43, 52, or 61 is marked on the Form 12A, examine applicable general substitutes listed on Form 13 to replace any of the manpower resources listed on the 12A record and its continuations.

(f) Repeat (d) and (e) above for each subsequent set of 12A records.

(g) If unable to start because of manpower, attempt to preempt (see below).

(2) Preempt Procedure

If unable to start with primary resources or any of the substitutions described above, attempt to start the task by preemption as follows:

(a) Only tasks that can provide required primary resources listed on the basic 12 card(s) for the task, and/or their general substitutes as listed on 13 cards, and have a lower priority than the task to be started may be preempted to start a task.

(b) The lowest priority task(s) that can provide the necessary resources is chosen for preemption.

(c) The maximum number of tasks that can be preempted by priority category are specified on the Forms 18 with applicable defaults.

(d) Attempt to scan and start preempted tasks by the same procedure as described above. It may be possible for a preempted task to restart with task specific substitutes listed on its 12A record(s) ("Ripple" effects will be very limited because lower priority tasks are always preempted).

(e) Preempt procedure to obtain resources conform to the standard procedures described in Section 15c except for the limitation in (2)(a) above.

(f) Preempted tasks are backordered in the same manner as normal tasks if unable to restart by substitution or preemption.

(3) Backordered/Restart Procedure

If a task cannot be started by resource substitution or preemption, it is placed in backorder. Restart is attempted by the procedure specified above any time one of the following becomes available:

(a) A resource listed on the basic 12 record(s) for the task.

(b) A substitute resource listed on a Form 13 record for a resource listed on any 12 and/or 12A card with an X in the corresponding column (43, 52, or 61).

(c) A resource listed on any 12A record for the task.

(4) Expedite Procedure

The expedite procedure is the standard procedure described in Section 15.

(5) Performance Summary Report (PSR) Outputs See Figure 9-52.

New statistics have been added to the PSR. The "Manhours Used" statistic is broken down into "Percentage used as a prime resource" and "Percentage used as a substitute resource." A substitute is a resource defined as a general substitute or defined as a member of a task specific substitute crew (Form 12A) and not defined on the original crew (Form 12).

The "Number of Men Demanded" statistics reflect the initial resources demanded and will include only prime (Form 12) required resources. The new "Number of Men Demanded Post Scan" statistic reflects the actual resources initially demanded after considering prime resource availability. It will include both prime and substitute resources. The "Percentage of demand" statistics have been renamed "% Available By" to describe the statistic better. All these subsequent "% Avail By" statistics are now computed based upon the "Nbr of Men Demanded Post Scan" statistic.

(6) Post Processor Tapouts

The main module tapouts provide necessary data for the Manpower Matrix Post Processors. Prime and substitute resource statistics displayed are described in Chapter V, Section D.

33. Time Controlled Activity Processing

Activities are placed on the schedule (exogenous file) by the Input Module at the activity time specified on Form 20. Each aircraft or non-aircraft resource requested on Form 20 which is available at frag time/activity time begins processing independently of any additional resources requested for the activity. In other words, the number entered in the max field on the Form 20 for an activity causes the Main Module to attempt to start that number of individual activities. At cancellation time only, the activities with an unfilled resource request are cancelled. Activities will not be cancelled once the resource requested on the Form 20 is assigned, even if a reconfiguration network is processed prior to the activity. See Chapter VIII for details of filling out Form 20s for activities.

C. Output Products

There are two specific outputs of the Main Module. They are: (1) simulation reports for the entire length of the simulation, and (2) a transaction file which is processed by the post processor system.

Included in the simulation reports are:

1. A print-out of the SPEC card selected run options.
2. A print-out of the change card file as processed.
3. Embedded diagnostics of a warning nature.
4. Performance Summary Reports at the specified intervals of time.
5. Other user selected output reports.
6. Timing and job processing statistics at end of run.
7. Applicable diagnostics and trace back information upon any abort.

D. Specific Output Reports

1. SPEC Card Information - See Figure 9-40.

All of the run specification (SPEC Card) options either selected by the user or defaulted are listed under this title. Included are any parameters or file assignments associated with the option. The report is automatic. See Chapter VI for details of all Main Module SPEC card options.

2. Initialization Data Report - See Figure 9-41

This report is a programmer oriented report which contains all the initialization information produced by the Input Module. There is no actual report heading, but its first entry is CONTR.DV and some number which will equal the size of the control table as reported in the Input Module run.

This report is automatically provided by the Main Module for program debug purposes. However, it can be diverted to a print file by using the DATA option on the SPEC card. This print file can be either a tape, permanent file, or a temporary file. However, if a programmer oriented problem arises and the file was a temporary file, the needed data will have been lost and a rerun required.

Unless specifically asked for information from this report, users should normally ignore the data within it, if printed, or should direct it to some other file.

3. Change Card Report/Aircraft Identity Dictionary

a. Change Card Report. See Figure 9-42.

This report lists all the Change Card input for the run. The report is headed by the title "The following variables were changed in SECIN." SECIN is the routine that processes all the Change Cards. The report is automatically provided.

Embedded within this report will be warning diagnostics when a Change Card or one of its parameters were incorrectly input. Sometimes a default will be used with a message informing what default was used. Other messages indicate the card itself was ignored. If an illegal Change Card name is used, the run will abort.

Normally, the diagnostic will print after the Change Card unless the card itself is incorrect or bad data such as alpha information is found in the integer (IPAR & IPAR2) or real fields (FPAR & FPAR2). In this case the system will abort the run because of read difficulties. Therefore, it is important that no illegal data (comment) be placed on the Change Cards anywhere within Column 1 through Column 50.

b. Aircraft Identity Dictionary. See Figure 9-42a.

This report lists the sequence number, tail-number, and tracking time interval of all the aircraft that have to be authorized. Embedded within this report will be diagnostic messages indicating overlapping tracking time intervals. If they are encountered then the second TRAKAC change card request will be ignored.

4. Exogenous Data Report - See Figure 9-42

This is only a one line report which always follows the printing of the SECIN change cards. It states "EXOG EVENT TAPE XXXXX BEING USED - COMMENT DATA." The XXXX refers to the keyword placed on the LIST card (2nd card) in the Form 20s that produced the flying program exogenous file and the "Comment Data" is that information on the same LIST card following the keyword.

This report makes it easy to track which exogenous file was used for the run when multiple flying program scenarios are used. It is always provided automatically.

5. Failure Clocks - See Figure 9-43

This report titled "Failure Clocks" prints only when the SWICH change card is used to turn SWICH 11 equal to 1. The report follows the Exogenous Data Report and begins on a new page. The column headings and their meanings are:

Headings	Description
NO.	Dictionary number of the failure clock.
DIST	The distribution type where; 0 or 10 = constant, 1 = normal, 2 = poisson, 3 = erlang, 4 = wiebull, 5 = exponential, 6 = lognormal, 9 = empirical, and greater than 10 = triangular.
MEAN	Applicable mean value in days or a decimal value.
VARIANCE	Applicable variance value in days or a decimal value, per the distribution type. For a triangular distribution, it is the sum of the optimistic and pessimistic values.
INITIAL VALUE	That value drawn from the distribution described.
RANDOM VALUE	The initial value multiplied by a random percentage - to simulate starting at a value less than the initial draw.
% VAR = PESS	The percent of the variance that represents the pessimistic value for triangular distributions.

The random value is the starting value for all clocks in the network.

6. Task Time Distributions - See Figure 9-44

This report contains no general heading, but prints immediately after the Failure Clock Report if the SWICH #11 set equal to 1. The report is primarily diagnostic in nature, in that, once seen for a simulation run, it is usually not asked for again. This is partially due to its volume and limited usefulness on subsequent runs.

It primarily is a report used to validate if proper task times were input. It reflects the highest and lowest possible random task times and reflects the entire spectrum of the task time distribution. Column headings are produced only on the first page of output.

Heading	Description
TASK	Task ID number from task dictionary.
TMEAN	Task mean value as input (in days).
LOG (MEAN)	The log of the mean when applicable for model use (normal & lognormal values only).
TVAR	The variance value as input (in days). For triangular distribution, contains the sum of the optimistic or pessimistic values.
HIGH DRAW	This value (in days) reflects the highest random draw for the task time based upon the mean variance values. For empirical distribution, many draws are made to insure this represents the highest value.
LOW DRAW	The opposite of the above.
(% TVAR = PESS)	The percent of the TVAR value that represents the triangular distribution pessimistic value. The remainder of TVAR is the optimistic value.

A general review of these High Draw - Low Draw and Mean Fields will give users confidence on the spread of their input task time distributions. Unwanted distribution spreads should be changed on the Form 12 task inputs.

7. Performance Summary Report - See Figures 9-51 and 9-52.

This Performance Summary Report (PSR) represents the primary output product of LCOM II. It consists of 75 overall performance statistics, divided into the following six groups.

Groups	No. Stats	Resource Info Collected On
Operations	14	Missions
Aircraft	14	Aircraft
Personnel	16	Men
Shop Repair	8	Parts
Supply	10	Parts
Equipment	13	AGE (ground equipment)

The report is triggered and frequency controlled through either the Form 10 subtype 01 input record or the RFREQ change card.

Referring to the example in Figure 9-51, there is one row of data for each of the 75 statistics. Aside from the "TOTAL" column, the columnar headings may be different for each of the six groups. The user controls, through Form 10, what is printed as columnar headings of the PSR. See Chapter VIII for details about preparing Form 10.

In general, statistics are accumulated during the simulation and assigned to a particular column of the report according to the value of a parameter. For most of the statistics, this parameter is a column number assigned to each resource item on Form 13. If, for example, it is desired that columns for the Supply portion of the report represent individual supply items (Parts), then each part would be assigned a separate column and then column headings for these items would be specified on Form 10. For groupings of supply items, then each supply item in that group is assigned a number representing the column under which the item's supply statistics are to be accumulated. If unit cost or demand rate categories are desired, rather than Work Unit Codes, then the appropriate category number may be assigned to each supply item, causing its statistics to be accumulated and presented in the corresponding column of the report.

Similar procedures apply to the other groups of statistics. Manpower statistics may be individually reported, grouped by shop, by skill level, by AFSC groupings, etc. Aircraft statistics may be distributed by aircraft type, by squadron, etc. Aggregations of these kinds are limited only to the extent that resource items can be assigned to columns of the report. There is no limit on the number of columns that may be used, except that imposed by the computer storage capacity. If more than 10 columns are used, the remaining columns will appear in repetitions of the group until all columns are printed.

The main exception to this procedure is for statistics in the Operations group. Here, the columnar split-out is controlled only by mission type on Form 17. The user still has the freedom, however, of defining mission types however he pleases and labeling the column headings to correspond.

The Input Module automatically provided one additional column called "other" for each section of the report. When processing the column assignments on Form 13 or 17, any erroneous or blank column assignments will automatically default to this other column.

Column headings for each resource can be changed in the MAIN module by the RPCOL change card. Alert replenishment and alert release activity column headings are set with the ALTCOL change card; the weather cancel report column is set with the WCXCOL change card.

For any given run of the Main Module, the Performance Summary Report may be produced in two levels. The Level I reports are produced automatically on a periodic basis as specified by the user: every day, every other day, every week, etc. Statistics shown in this report represent performance during the indicated period. The Level II reports are produced for a given multiple of the Level I reports by using the RCYC change card and contains summary statistics over the longer time period. Thus, Level I reports may be produced each day, with Level II reports representing 7-day summaries; or Level I reports may appear weekly with Level II reports containing 4-week summaries, etc. The formats of the Level II reports are identical to those of Level I; the only difference between the two levels is in the time period over which the statistics is aggregated.

Most of the line entries on the Performance Summary Report are more or less self-explanatory. For any line entry with "100" or "1000" shown in parenthesis, the corresponding data should be multiplied by this number. For example, data for Total Dollar Investments, Lines 54 and 68, is printed in thousands of dollars. Where an "EOP" appears in parenthesis, the statistic represents status as of the end of the reporting period as shown in the report heading. All other line entries represent statistics accumulated during the reporting period.

Statistics are actually numbered sequentially by the MAIN module. However, the LCOM I statistic numbers are still printed for programmer tracking and debug. Future versions of the MAIN module will eliminate these numbers and substitute the actual numbers. See Decoder output Figure 5-2 for actual statistic number assignments. For the time being, the number printed should be referred to as the "Old Stat Number."

Some of the statistics have special interpretations in accordance with the way in which they are computed. These statistics are further described individually in Appendix G using the "Old Stat Numbers" as references.

8. Resource Data Report - (ITEM) - See Figure 9-47

This report must be requested by using the ITEM change card. Since it is a snapshot report, it represents the resource conditions "as of" a point in time. Therefore, multiple Item change cards can be used specifying the exact time in simulation days that this report is to be printed.

The report is described as follows:

Column Heading	Description
RES NUMBER	The dictionary assigned number for the resource.
REPORT COLUMN	The PSR report column where this resource's statistics are collected.
RESOURCE TYPE	Aircraft, men, parts, AGE, or other.
NUMBER OF SUBST	Number of general substitutes this resource has.
RES COST	Input cost for this resource, largest print value is 999936.00.
AUTH QUAN	Current authorized quantity. Does not reflect a value for those resources on a shift.
ON HAND BAL	The number on-hand, i.e., those serviceable items not in use.
DUE IN BAL	The due-in-balance, i.e., the number of items to be replaced in the on-hand pool.
DUE OUT BAL	The due-out-balance, i.e., those items for which a demand has been recorded but not yet filled.
NO. OF DEMANDS	The number of demands that have been made on the resource since simulation began.
CUTIL FACTOR	An indication of the utilization of this resource since the simulation began. A negative value indicates that there has been more waiting for this resource than there has been time that the spare resource was available.
UTIL	The utilization index computed from CUTIL. Should always be zero.
USHP	Indicates row in the shift table containing the resource authorizations. It will be zero for resources not on shift.
LAST TIME OF UPDATING	The time that CUTIL was last incremented or decremented.

Through this report the networking of resource utilization and resource balancing within the simulation can be verified, i.e., for each consume there was a generate; resources balance with the formula AUTH = ON-HAND + DUE-IN; also, resource demand patterns can be evaluated by requesting multiple reports.

Non-manpower constraining efficiencies can be reviewed with the CUTIL FACTOR. Values slightly above zero indicate good constraining. High values indicate poor constraining and negative values indicate over constraining. Users must work with this statistic in conjunction with the authorized quantity and no. of demands to establish meaningful statistical values as limits for this general constraining evaluation.

The last resource (row) listed in this report has a resource type of other. This is an automatically assigned resource the Main Module uses when users place a generate on Form 12 (asterisk in Col 29) and leave the associated resource field (Columns 30-35) blank. Users should not be concerned with this resource unless the value exceeds the authorized quantity of 9999. An AUTH change card can modify this default quantity. The AUTHA card also affects it.

9. Aircraft Configuration Status Report - (QSTAT) - See Figure 9-46.

This report is titled the Aircraft Class/Configuration Report and provides, in a matrix format, the number of aircraft actually in each external configuration at the user specified request time. Within each class, the total is broken down by aircraft status (i.e., 'Ready,' 'Cocked,' 'Processing'). The columns of the matrix represent the aircraft configurations. From left to right, the first column under the word CLASSES represents the first configurations defined on the Form 17 and the last column represents the last configurations defined on the Form 17 (if only six configurations were defined, there would be only six Class Columns in the report). Each row represents an aircraft flag status. Table 4-3 describes all the aircraft status flag values. This information will aid in interpreting the QSTAT Report. The first three rows represent the basic flag values of 'Ready' (Ø), 'Cocked' (20), and 'Processing' (greater than 20). Subsequent rows in the Detail Report Portion provide an expanded look at the "Processing" row (row 3). Class and flag status totals are provided to the right of the first 3 rows as well as, total-on-hand, total authorized, and the total number of outstanding aircraft requests not yet satisfied.

The first configuration (Column 1) is the configuration the aircraft are in at the beginning of the simulation. Multiple QSTATS during the simulation provide an insight as to what is happening to the aircraft.

An important use of the QSTAT report is to assist the analyst in locating errors in the Forms 17 and 21. A build-up or pooling of aircraft in any configuration indicates that one or more of the search patterns may need to be modified, otherwise, serious bottlenecks of aircraft availability will occur.

Conversely, the QSTAT report will be most helpful to users wanting to create a pooling effect of a specific aircraft configuration. This pooling might be for special alert pooling, etc. The QSTAT report can verify that the proper action was being taken.

10. In-Process & Backorder Status Reports - (IPSTAT and BOSTAT) - See Figures 9-48 and 9-49.

These reports give information on all tasks in the system, both those being accomplished and those which are waiting to be accomplished. They are not automatic reports. They must be triggered by the IPSTAT and BOSTAT change cards. They are snapshot reports and thus provide only an "as of" status. The column headings are generally self-explanatory but are described as follows:

Column Heading	Description
TASK ID	Dictionary number assigned the task.
JOB PRI	Individual job priority, not the group priority assigned on Form 12.
NEXT INDEX	The Index of the control table where the subsequent task is located.
RES ID	The dictionary identity of the resource that is being processed.
TIME IN	On IPSTAT report = time job started. On BOSTAT report = 0.0.
TYPE OF RES	Type of resource; aircraft, men, parts, or age that is processing.
AC FLAG	If aircraft is processing = the Status Flag value. For non-aircraft resources = 0.
ID	Required resource used on job.
QTY	Quantity of above resource required. If negative, resource is to be consumed.

NOTE: Remainder of columns are programmer oriented data. Contact programmer for information about these if required.

11. Mission Status Report (MNSTAT) - See Figure 9-45.

This report provides a snapshot view of the "as of" status of the outstanding missions, either still required or in-process. The report is not automatic and requires triggering by means of a MNSTAT change card. There can be multiple requests for this report. The report is automatically triggered the first 10 times that diagnostic message 510 is printed and will aid in establishing proper Form 21 records. The column headings on this report are described as follows:

Column Heading	Description
ID	The identification of the mission, used by the Main Module.
TYPE	Mission type, defined by user.
NAME	Alpha Name given this mission on Form 17.
PRI	The priority of the mission (from Form 20).
MIN	The minimum number of aircraft which must be available for mission accomplishment.
MAX	The maximum number of aircraft that were requested for the mission.
T/O TIME	Scheduled take-off time.
DURATION	Duration of the mission.
CANCEL-T	The allowable waiting time before cancellation of the mission (hours after T/O time). (In days & hours & minutes format.)
TRN	The internal reference identification (tail) numbers of those aircraft assigned to the mission.
RES.ID	The ID of the aircraft type (from Resource Dictionary). If value is negative, the TRN number is still the request, not the aircraft tail number, aircraft has not yet been assigned.
STATUS	The status flag of each aircraft (see Figure 4-3).
NAME	Alpha name of aircraft type (Res ID).

12. Most Trouble Report - See Figure 9-50

This report is not implemented completely. It will always contain zeros.

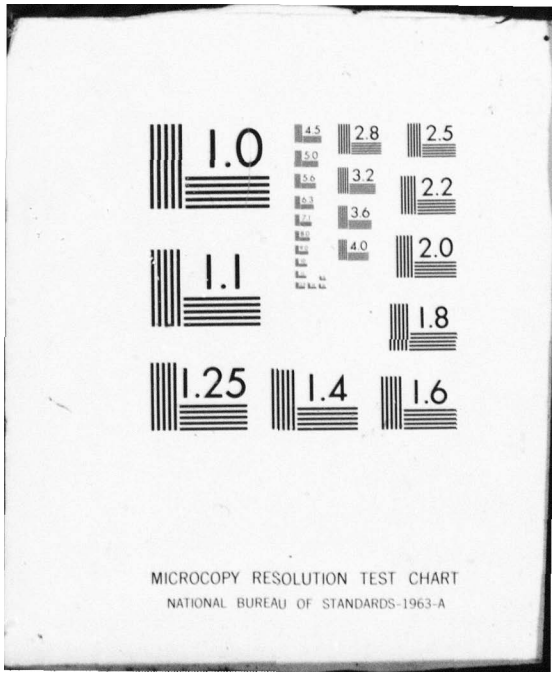
13. HIT MATRIX Report - See Figure 9-53

The HIT Matrix Report is a summary by Control Table Index of the actual results of the simulation period specified for the report. It contains the number of times that a particular node (Control Table Index) was reached, and the number of times the task at that node was set up. All applicable parameters are printed in the report as an aid to interpretation. A substantial amount of information can be obtained from the report as to how the network processed. Tasks controlled by Failure Codes can be validated as to proper quantities, processing of A and E selection parameters can be verified, etc. The HIT Matrix Report is structured on a page-by-page basis exactly like the Control Table Dictionary for easy cross referencing.

AD-A083 759 AIR FORCE MAINTENANCE AND SUPPLY MANAGEMENT ENGINEERI--ETC F/G 9/2
LCOM II SIMULATION SOFTWARE USERS REFERENCE GUIDE,(U)
OCT 79 W F DRAKE, R C REISS
UNCLASSIFIED AFMSMET-78-5.1 NL

2 OF 5
AD A083759




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

a. Data/Report Activation - See CHANGE Card Specification

(2) The collection of HIT MATRIX data for a particular interval of time is implemented by using a HITMAT change card. The time the collection of data is to begin, and the time the collection is to stop is specified on the HITMAT card. At the stop time the HIT MATRIX report is printed and the matrix is cleared. The user may schedule several HIT MATRIX reports during a simulation by inputting a different HITMAT card for each report.

CAUTION: The time interval specified on the HITMAT change cards for an individual simulation run cannot overlap. The first card read for a reporting period will be implemented, and the other cards during the same period will be ignored.

b. Interpretation of Report Headings

Report Titles	Description
FROM BRANCH	Control table row indices where processing has reached.
TO BRANCH	Control table row index for the next task.
ALT BRANCH	Control table row index for the first parellel task.
TASK-ID	Dictionary ID of the task attempted to be processed at the particular row position in the control table.
PROC ATTEMPT	A counter indicating the number of times the particular control table row has been reached (Process Attempted).
PROC INIT'D	Counter indicating the number of times the task on the particular control table row was set-up (Process Initiated). Set-up does not always mean started or completed. The task could be completed or in-process at the time of the report or could have been set-up, then placed in backorder because of resource non-availability. SETUP does, however, mean that the task will be accomplished during the simulation when resources are available.
PARAM VALUE	This is the parameter value of the particular control table row position. Applicable only on A, E, and G selection modes.
M	The defined selection mode for the particular table row.

c. Special Notes

Several processing features in the Main Module cause the counts in the PROCESS ATTEMPT and INIT'D columns to be other than what might be expected. By understanding these differences, a good deal of insight into the processing results can be obtained. The processing feature and its effect on these counts are:

(1) Timing of when the HIT MATRIX standup time is requested - affects the time when counts are made. For example, in a network with a sequence of tasks - A, B, C, D, if the HIT MATRIX start up time happened between the processing of B and C, the counts of A and B would be lower than C and D. This effect will be more apparent on HIT MATRICES started at a time other than zero, e.g., subsequent HIT MATRICES.

(2) In order to speed up processing, the Main Module attempts to skip over any branch with a dummy task on it. This cannot be done easily if the branch has a parallel task, therefore, often only the final parallel branch in a set is skipped over and not counted. This affects the last in a set of parallel Es, As, or Gs if the tasks defined are dummys. No INIT'D count can thus be taken. Thus, with two E branches with 20 and 50 percent respectively, no task defined on each branch, and a count of 100 on each branch's PROCESS ATTEMPT, the PROCESS INIT'D will be 20 on the first branch and ZERO (0) on the last.

(3) When the aircraft reach the sortie task and scheduled take-off time has not been reached or not enough aircraft are available, the model causes the aircraft to wait. Subsequently, at mission time, the aircraft are, in effect, reinserted in the network at the sortie task causing the PROCESS ATTEMPT count to be increased. This effect can result in a count of the PROCESS ATTEMPTs double that of the PROCESS INIT'D on the sortie task. Some inferences can be made of the relationship between the ATTEMPT (A) and the INIT'D (I) counts. With "A" double "I" all aircraft are Pre-Sortie processing in less than scheduled take-off time minus FRAG time. The closer these numbers agree and the mission MAX A aircraft equals one, the more aircraft are taking the entire lead time to process pre-sortie tasks. This A/I relationship is, of course, affected by the MAX aircraft parameter.

(4) The Main Module wants to directly assign cocked aircraft to the sortie task but since it has only the entry point, it must insert the cocked aircraft at that point. In this case, the dummy task is inserted for each pre-sortie task and therefore, these pre-sortie tasks are not processed, in effect skipped. No count of them will be taken on the INIT'D, but the ATTEMPT will reflect the count including the cocked aircraft.

(5) Several additional analysis items are sure to be discovered and the HIT MATRIX will reflect them in some way or another, probably for the benefit of user analysis.

d. Use Considerations

The use of this option by the user as a debugging tool cannot be overstated. It must be used to insure correct networking and that a long enough sample has been simulated. If the initiated count does not approximate the percent values represented by the A, G, or E selection modes, the networking is incorrect (not reaching that point correctly) or the number of days simulated is not enough to obtain a representative sample.

e. Report Costs to the User Are:

(1) Core equal to the control table size is required, e.g., 5000 control table entries cost an extra 5K in the run.

(2) Reports will be printed down the page split into two halves. Therefore, print costs will be equal to 1/2 the length of the control table, e.g., for the above example, the print lines will be 2500 plus titles on each page.

14. Programmer Level Reports

There are three basic programmer reports. They are: (1) an Aircraft Transaction Display, (2) the Software Routines Entry/Exit Display, and (3) Full Transaction Display. Briefly, they are described as follows:

a. Aircraft Transaction Display

This report is triggered with the DSPLAY change card using the FPAR field. The information displayed is a detailed transaction dump of all Main Module processing of the aircraft requested on the DSPLAY card and all processing of resources generated from that aircraft. No attempt will be made to describe the various display records here except to say that they will be of significant volume and will trace the processing action throughout all routines of the simulation software.

b. Software Routines Entry/Exit Display

This report is for tracing down the general location the software was processing during simulation when an abort condition ocurred. It aids in isolating serious problems and should be used only in such cases and under programmer control. It is activated by SWICH #14. It produces a volume of data output.

c. Full Transaction Display

This report is identical to the Aircraft Transaction Display report but is accomplished simultaneously for all aircraft and non-aircraft resources processing. Output volume is extremely voluminous, for example, approximately one inch of computer paper (full pages) can easily be printed for one hundredth of a simulated day (15 minutes of simulation time). Only the tracing of severe problems (program or data) should require use of this report. It is activated by SWICH #14.

15. Stop or Record Memory Report - See Figure 9-54

This report is located at the end of the run and begins with the words "You were stopped..." giving the simulation time when the run stopped. The data entries are as follows:

Data Title	Description
THE ELAPSED TIME IN SECONDS IS	The time given will agree with the CPU time in the Execution Report.
TOTAL JOBS STARTED	Self-explanatory.
TOTAL JOBS COMPLETED	Self-explanatory. The difference between the started and completed jobs will equal the sum of the number in-process and in backorder at the simulation time of the report.
TOTAL JOBS PRE-EMPTED	Number of jobs that had one or more pre-emptions during simulation.

16. Core Usage Report

Message	Description
XX unused words	If message is present, it will be located on the last page of output. It is an indication of over-assignment of memory for the run. Reduce the memory assigned by this value for optimum memory utilization.
YY acquired extra pages	If message is present, it will be located on the last page of output. It is an indication of under-assignment of memory for the run. Increase the memory limits assigned to the run by this value (times 1000) for optimum memory utilization.

17. Abort Situation Products - See Figure 9-55

When an abort condition occurs within the main module, the SIMSCRIPT II language provides detailed diagnostic reports which contains the following:

1. A SIMSCRIPT error message number and associated descriptive text.

2. A trace back report to help isolate the section of the software that was being processed when the abort occurred. Specific line numbers, routine names, and key data are printed.

3. Time of simulation abort is given as "TIME.V = XX."

4. An input/output file status report.

A detailed description of these reports can be found in SIMSCRIPT II user documentation.

Abort recovery is attempted by LCOM II subsequent to printing the above SIMSCRIPT II reports. At this time, if it is possible, the entire initialization is printed along with as many user reports as possible, all of which will be "as of" the time of the simulation abort. This printout will be voluminous but the data can be valuable in diagnosing the abort situation. When LCOM II aborts, contact AFMSMET for assistance in resolving the problem.

V. POST PROCESSOR MODULE

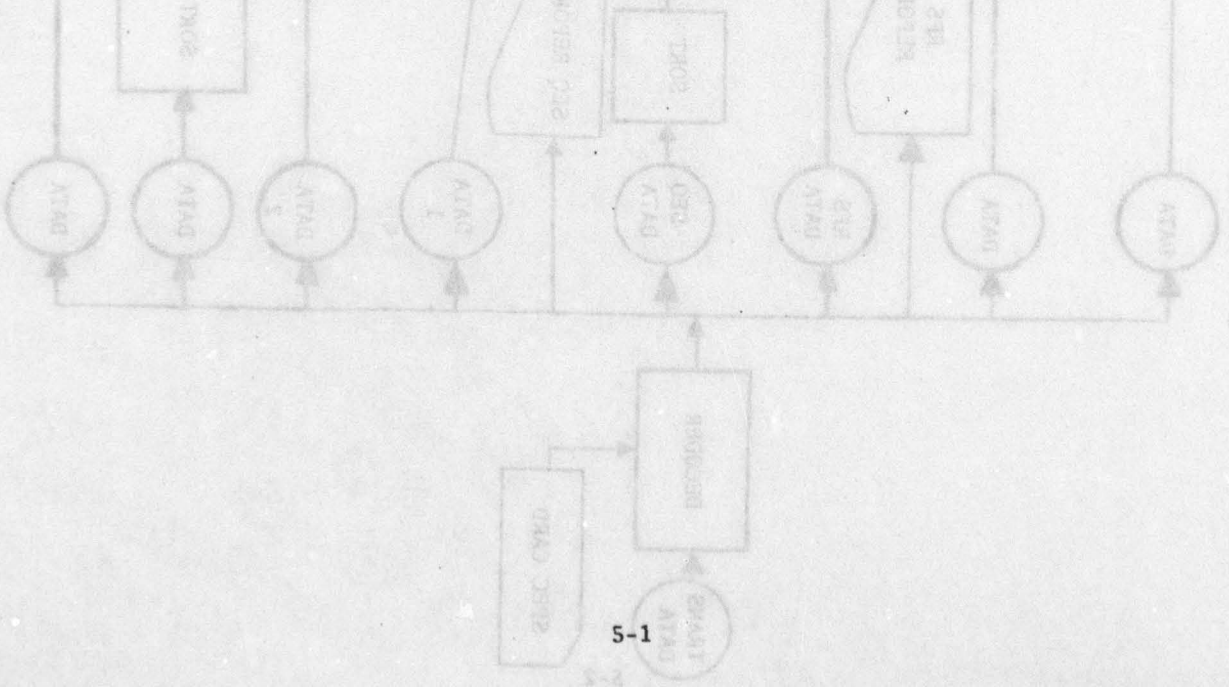
A. GENERAL DESCRIPTION

During simulation, it is possible to generate a large amount of detailed data representing simulation results. The data may then be combined, summarized, and consolidated into output reports of various kinds. In many large simulation models, data generated during the simulation are processed afterward by a separate program called a post processor to obtain the summary reports. In LCOM II, the simulation program itself produces the main Performance Summary Report (PSR) as it operates. However, there is also a separate Post Processor Module that produces several ancillary products. The PSR and other reports produced during the simulation reflect the behavior and status of the simulated environment during discrete time intervals or at specific points in time in accordance with the reporting interval. To obtain results over the entire simulation, a number of output records must be inspected. This is the function of the Post Processor Module in LCOM II - to develop, within single products, selected summary statistics covering the entire simulation. In effect, it consolidates the periodic reports produced during the simulation. It also produces aircraft, manpower and part status information as a function of simulated time rather than at specific points in time as output during the simulation.

More specifically, the Post Processor Module produces seven kinds of output report showing simulation results as functions of simulation time. These products are displayed in either graphical or tabular form by the various portions of the Post Processor Module. The products displayed are as follows:

Product	Produced By
PSR statistic graphs (results vs time)	GRAPH Post Processor
Aircraft time line displays	DISPLAY Post Processor
Manpower matrices (requirements vs time of day)	MATRIX Post Processor
Analysis of parts usage/availability	PARTS Post Processor
Mission statistical summary analysis	MISSION Post Processor
Realized Flying Schedule (RFS) data	Transaction DECODER
Support equipment usage data	Support Equipment Post Processor

The Transaction DECODER program provides the interface between the Main Module and the post processors. It performs the functions of interrogation, separating, and reformatting the data.



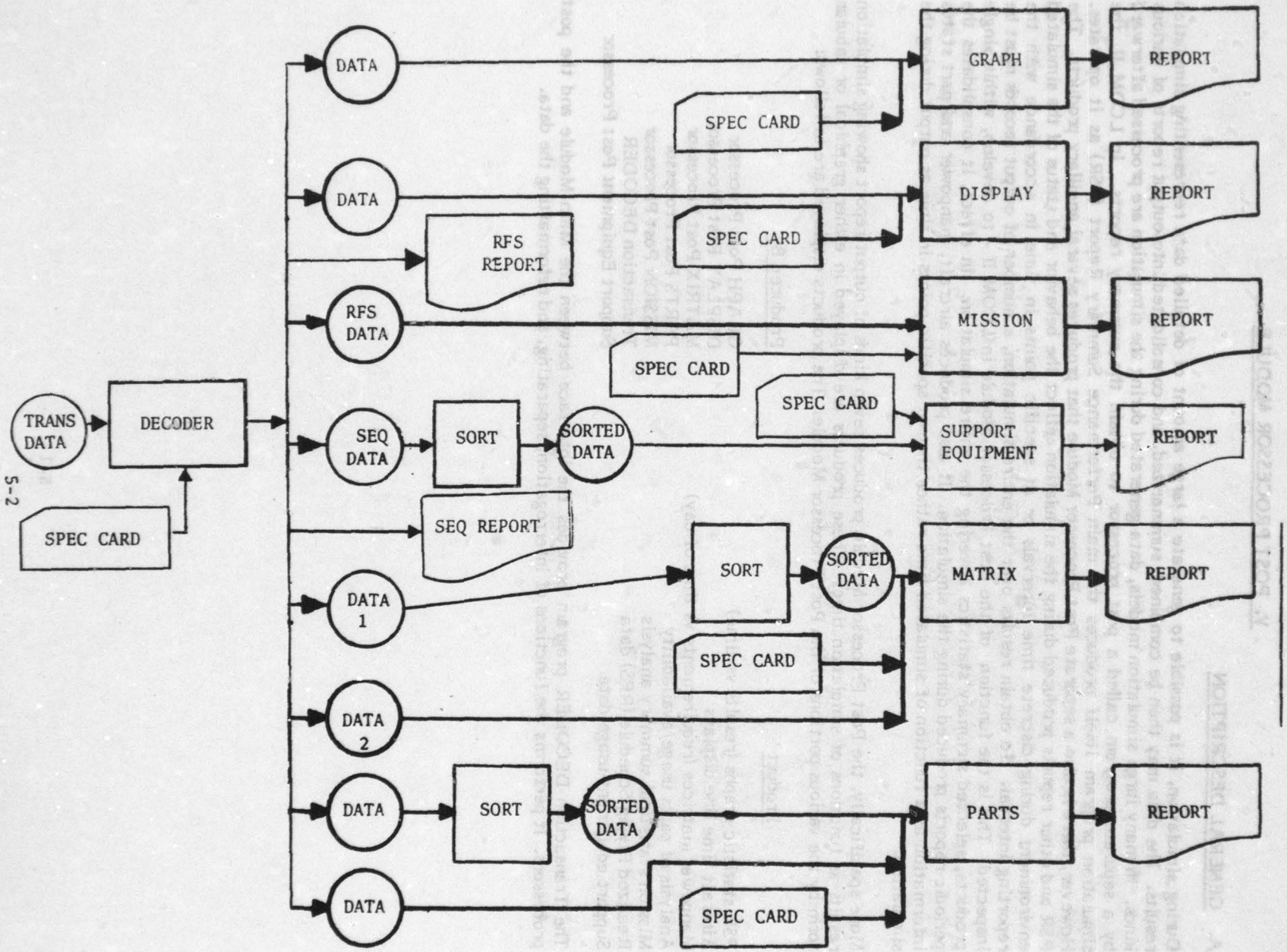


FIGURE 5-1 POST PROCESSOR MODULE FILE STRUCTURE

B. DATA FILES DESCRIPTION AND FLOW

The major goal of the LCOM II Post Processor Module is that of providing the users with a simplified method for the execution of the post processors. To accomplish this, both an integrated data interface with the Main Module was developed, and a uniform procedure for executing each post processor was utilized. The file structure for the Post Processor Module is shown in figure 5-1 and the description of them is as follows:

. TRANSACTION DATA is the information from the Main Module containing combined data for all post processors. This is a binary tape with the records in random sequence.

. DATA are the individual files containing the necessary information for each of the post processors. Some of the files are converted by the decoder to a BCD format when sorting or printing is necessary. The remaining ones are in binary.

. Spec Cards are the user supplied cards for describing any necessary information or options regarding their execution. At least one card is required for each of the post processors, including the Transaction Decoder. See Chapter VI Program SPEC Cards.

. Reports are the output products from the Decoder and the various post processors.

. RFS DATA is the print-out and files of the Realized Flying Schedule as accomplished in the simulation.

. SEQ DATA is the print-out and files of the Support Equipment transactions during simulation.

The Main Module produces a single file as output. This file contains in a binary format all records which were requested from the Main Module for subsequent processing by post processors. This binary method results in a tremendous savings in I/O time in the Main Module by eliminating formatting and data conversion and provides only those outputs specifically requested by the user. All data must be requested within the Main Module. None will be automatically generated. Therefore, no post processor can be used unless its data was requested.

C. TRANSACTION DECODER

Because not all users will want to use all the post processors, all users are not penalized by being forced to load one large program that would result from integrating the post processors. Therefore, the post processors remain as separate programs with separate files for each one. The Transaction Decoder has been provided to interrogate the Transaction Data file and separate all the records by post processor. Records on the Transaction Data file that are not requested will not be output to a file for further processing. This Decoder is required before running any of the post processors. The program will insure the proper data sequence, reduce the volume of data that is necessary at any given time and provide BCD data for sorting. It may be run as the last activity of the Main Module or as a separate job. Figure 5-2 illustrates the Transaction Decoder's output.

The data for the Matrix, the Parts, and the Support Equipment Post Processors require a sort for proper sequencing. For this reason the Decoder produces this data in a BCD format. This sort process will be discussed in more detail later. The Realized Flying Schedule Data is used by the Mission Post Processor and several additional programs and for debugging LCOM II data errors. For these reasons the Decoder will produce this data in BCD format, and if requested on its SPEC Card, will print the data for debug purposes. The additional programs used to process the Realized Flying Schedule Data have not been integrated into the LCOM II Simulation Software.

```
                                    LCOMII STANDARD VERSION  HIS  RELEASE  3.5
SPEC GRPD=9 PRTS=10 MTRX=13 DPLY=12
SEQ=8 RFS=11 DRUG=0 *
THE FOLLOWING POST PROCESSORS WERE REQUESTED USING THESE LOGICAL UNITS
     GRAPH POST PROCESSOR OUTPUT UNIT =  9
     DISPLAY POST PROCESSOR OUTPUT UNIT = 12
     RFS POST PROCESSOR OUTPUT UNIT = 11
     PARTS POST PROCESSOR DICTIONARY OUTPUT UNIT = 10
                          BCD DATA OUTPUT UNIT = 14
     MATRIX POST PROCESSOR DICTIONARY OUTPUT UNIT = 13
                           BCD DATA OUTPUT UNIT = 15
     SUPPORT EQUIPMENT POST PROCESSOR OUTPUT UNIT =  8
     THE 'POST' FILE OR INPUT UNIT =  1

   USE THE SEQUENCE NUMBER TO THE LEFT OF EACH DESIRED STATISTIC FOR PRINTING IN THE GRAPH POST PROCESSOR.

     1      1 NUMBER OF MISSIONS REQUESTED          2      2       NUMBER ACCOMPLISHED          3      3       PERCENT ACCOMPLISHED
     4      6 NUMBER OF SORTIES REQUESTED           5      7       NUMBER ACCOMPLISHED          6      8       PERCENT ACCOMPLISHED
     7     T1 NUMBER OF WEATHER CANCELS             8     T2 NUMBER OF WEATHER DELAYS           9     T3 NUMBER OF ALERT REPLENISHMENT
    10     T4 NUMBER OF ATTRITIONS                 11     T5 NUMBER OF RAM REPAIRS             12     T6 NUMBER OF AIR ABORTS(TOTAL)
    13     13 NUMBER OF AIRCRAFT AUTH.(EOP)        14     14 NUMBER OF AIRCRAFT-DAYS AVAIL     15     15      PCT SORTIES(INCL ALERT)
    16     16       PCT UNSCHED MAINTENANCE        17     17       PCT SCHED MAINTENANCE       18     18      PCT NORS
    19     19       PCT MISSION WAIT STATUS        20     20       PCT SERVICE + WAITING       21     21      PCT OPERATIONALLY READY
    22     22 AVG. AC POST SORTIE TIME(HRS)        23     23 AVG. NO. OF SORTIES/ A/C /DAY     24     24 FLYING HOURS
    25     T7 NUMBER OF FCF TASKS FLOWN            26     T8 AVG. AC PRESORTIE TIME(HRS)       27     27 MANHOURS AVAILABLE (100)
    28     28 PERCENT  UTILIZATION                 29     29 MANHOURS USED (100)               30     30 PCT UNSCHED MAINT. OF STAT 29
    31     31 PCT SCHED  MAINT. OF STAT 29         32     P1 PCT PRIME          OF STAT 29     33     P2 PCT SUBSTITUTE     OF STAT 29
    34     33 NUMBER OF MEN DEMANDED               35     P3 NBR OF MEN DEMANDED POST SCAN     36     34 % AVAIL BY OH. BAL. OF RES
    37     35 % AVAIL BY GEN SUBS OF RES           38     36 % AVAIL BY EXPEDITE PROC.         39     37 % AVAIL BY PREEMPTION PROC.
    40     38 % DEMANDS NOT AVAIL FOR RES          41     39 OVERTIME MANHOURS USED (100)      42     48 SIMULATED MH PER FLYING HOUR
    43     44 NO. OF REPARABLE GENERATIONS         44     45       PCT BASE REPAIR             45     46      PCT DEPOT REPAIR
    46     47 AVERAGE BASE REPAIR CYCLE            47     48       PCT ACTIVE REPAIR           48     49      PCT WHITE SPACE
    49     50 NO. OF ITEMS IN REPAIR (EOP)         50     51 NO. OF ITEMS BACKLOGGED (EOP)     51     54 TOT DOLLAR INVEST.(1000)(EOP)
    52     55 FILL RATE PERCENT                    53     56 NUMBER OF BACKORDER-DAYS          54     57 NUMBER OF UNITS DEMANDED
    55     58       PCT OFF-THE-SHELF              56     59       PCT EXPEDITED REPAIR        57     60      PCT PREEMPTION
    58     61       PCT DEMANDS NOT SATIS.         59     62 NUMBER OF CANNIBALIZATIONS        60     63 NO. ITEMS ON BACKORDER (EOP)
    61     68 TOT DOLLAR INVEST.(1000)(EOP)        62     69 EQUIPMENT HOURS AUTH. (100)       63     70 EQUIPMENT HOURS AVAIL. (100)
    64     71       PCT USED-UNSCHED MAINT         65     72       PCT USED-SCHED MAINT        66     73      PCT UNUSED
    67     74 NUMBER OF BACKORDER-DAYS             68     75 NUMBER OF UNITS DEMANDED          69     76      PCT AVAILABLE
    70     77       PCT PROV. BY EXPEDITE          71     78       PCT PROV. BY PREEMPTION     72     79      PCT DEMANDS NOT SATIS.
    73     80 EQUIP HOURS BACKLOG(100)(EOP)

PUT THESE VALUES ON THE GRAPH 'SPEC' CARD     DAYS=  10 FDAY=   0, IF NON-ZERO.


  1480 RECORDS WERE WRITTEN TO THE GRAPH FILE.
   324 RECORDS WERE WRITTEN TO THE DISPLAY FILE.
    10 RECORDS WERE WRITTEN TO THE PARTS  BINARY FILE.
 10980 RECORDS WERE WRITTEN TO THE PARTS  BCD FILE.
     1 RECORDS WERE WRITTEN TO THE MATRIX BINARY FILE.
101875 RECORDS WERE WRITTEN TO THE MATRIX BCD FILE.
  5597 RECORDS WERE WRITTEN TO THE RFS FILE.
  1190 RECORDS WERE WRITTEN TO THE SUPPORT EQUIPMENT FILE.
     0 RECORDS WERE WRITTEN TO THE TASK POST PROCESSOR FILE.
DECODER PROGRAM COMPLETED. PLEASE ANALIZE AND CORRECT ERRORS BEFORE RUNNING ANY POST PROCESSOR.
```

FIGURE 5-2. TRANSACTION DECODER SAMPLE OUTPUT

D. POST PROCESSOR DESCRIPTIONS:

1. GRAPH POST PROCESSOR

a. Data Activation/Generation

This is requested within the Main Module Change Card file with a GRAPH card. See Chapter VII, Change Card Specifications, for format and card content.

b. General Description

This post processor output consists of selected summary statistics that the computer plots in graphical form as functions of simulation time. Statistics produced in this manner are selected from among those contained in the Performance Summary Report (PSR) produced during the simulation. Any or all PSR total column statistics may be selected. There is no automatic printing of graphs. They must be requested on the Graph Post Processor SPEC card. Each statistic selected for display in this form is plotted on a separate page, as illustrated in Figure 5-3. The headings used for the graphs are read in from the Main Module and appear identical to the PSR row headings. Although the graph for each statistic has simulation time as the abscissa, the ordinate may be scaled according to the particular statistic involved. The graphs have a flexible y-axis with a maximum of fifty lines. The interval used in each graph is calculated so that any frequency can be printed.

Graphs that have no values will not be printed. Instead, a line indicating that the maximum was zero will print.

The interval of days to be plotted is specified by the user and can be as long as the actual simulation. Each point on a graph represents the value of the requested statistic at the time a PSR is produced. Each graph is plotted with at most 60 PSR's to a page.

These graphs enable a user to discern trends in the simulated environment over time. They also detect functional interactions such as the way in which aircraft NORS rates change as supply fill rates decrease or increase.

Within the Graph run a Histogram of the "AVG Aircraft Post Sortie Time" is produced. Figure 5-4 is an example of the Histogram. It is automatically produced when the Graph Post Processor executes regardless of the number of statistic graphs requested. Thus, a user could obtain this Histogram without requesting any statistic graphs. However, the GRAPH change card would have been necessary when running the Main Module to produce the necessary data.

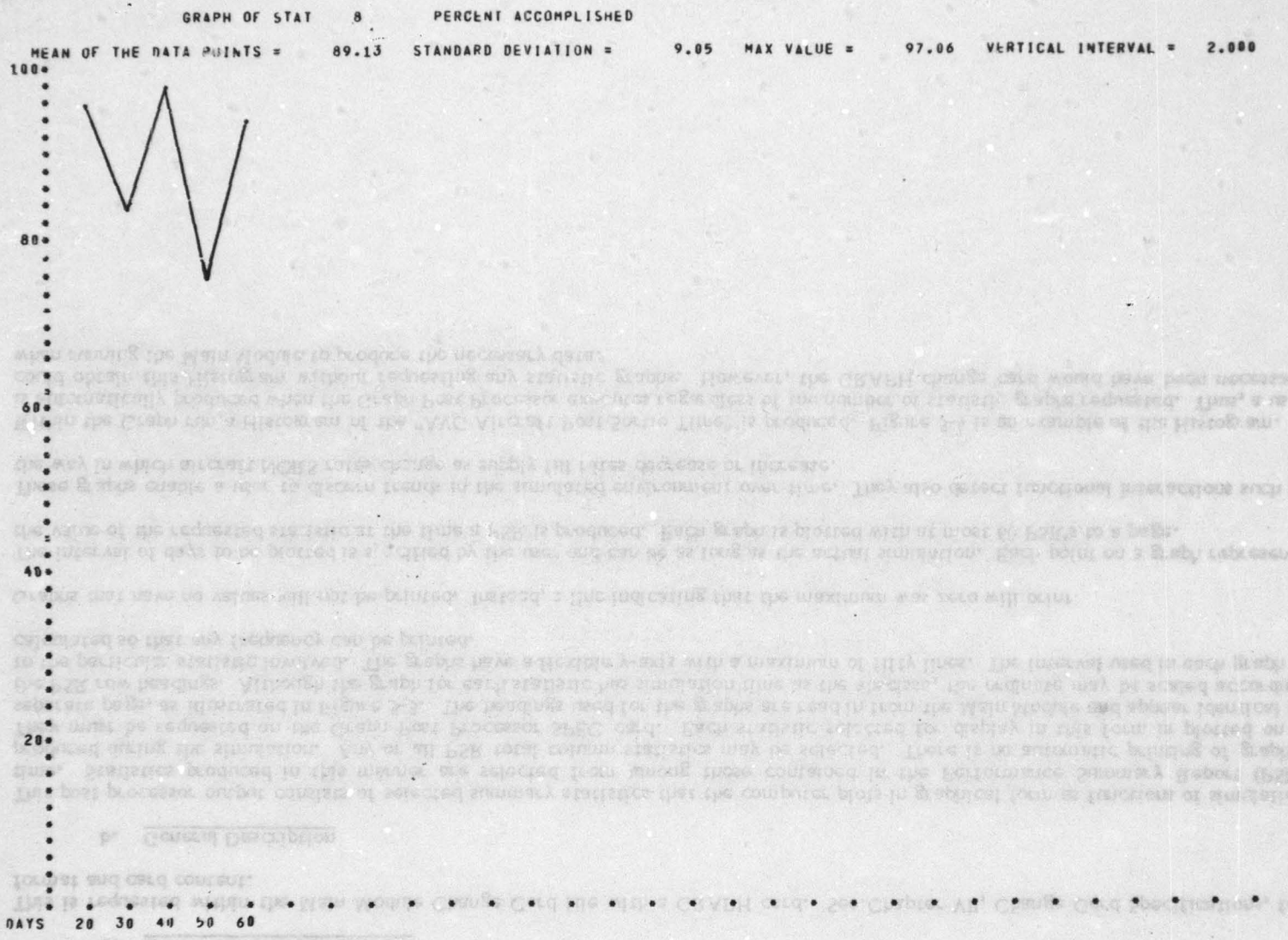


FIGURE 5-3. GRAPH POST PROCESSOR SAMPLE STATISTIC GRAPH

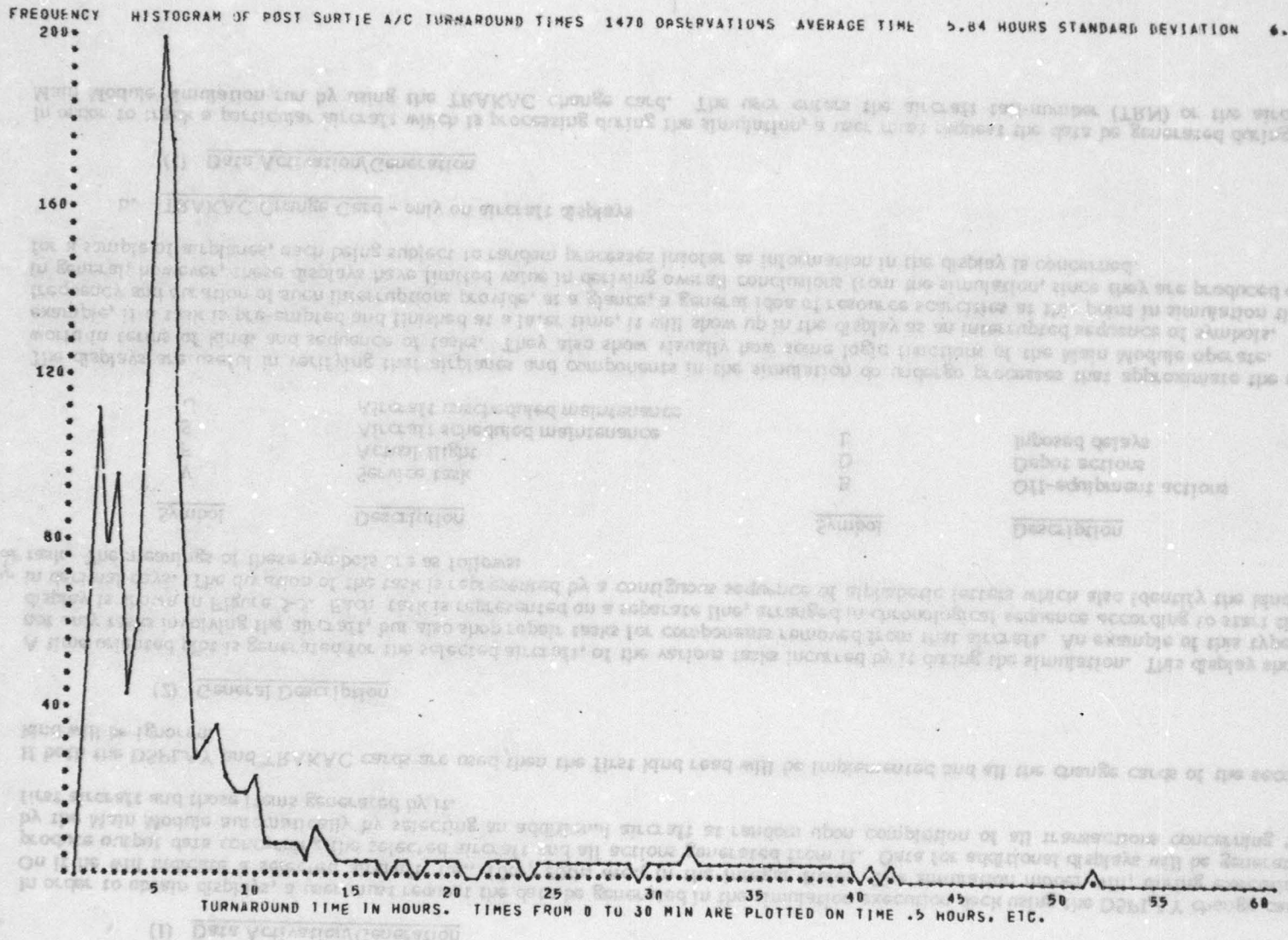


FIGURE 5-4. SAMPLE HISTOGRAM OF AVG AIRCRAFT POST SORTIE TIME

2. DISPLAY POST PROCESSOR

a. DSPLAY Change Card - Both on and off aircraft displays

(1) Data Activation/Generation

In order to obtain displays, a user must request the data be generated in the simulation execution deck using the DSPLAY change card. On it he will indicate a selected aircraft, i.e., 10th, 20th, etc., in the integer field. The simulation model will, during execution, produce output data concerning the selected aircraft and all actions generated from it. Data for additional displays will be generated by the Main Module automatically by selecting an additional aircraft at random upon completion of all transactions concerning the first aircraft and those items generated by it.

If both the DSPLAY and TRAKAC cards are used then the first kind read will be implemented and all the change cards of the second kind will be ignored.

(2) General Description

A time oriented plot is generated for the selected aircraft, of the various tasks incurred by it during the simulation. This display shows not only tasks involving the aircraft, but also shop repair tasks for components removed from that aircraft. An example of this type of display is shown in Figure 5-5. Each task is represented on a separate line, arranged in chronological sequence according to start time in decimal days. The duration of the task is represented by a contiguous sequence of alphabetic letters which also identify the kind of task. The meanings of these symbols are as follows:

Symbol	Description	Symbol	Description
V	Service task	B	Off-equipment actions
F	Actual flight	D	Depot actions
S	Aircraft scheduled maintenance	L	Inposed delays
U	Aircraft unscheduled maintenance		

The displays are useful in verifying that airplanes and components in the simulation do undergo processes that approximate the real world in terms of kinds and sequence of tasks. They also show visually how some logic functions of the Main Module operate. For example, if a task is pre-empted and finished at a later time, it will show up in the display as an interrupted sequence of symbols. The frequency and duration of such interruptions provide, at a glance, a general idea of resource scarcities at this point in simulation time. In general, however, these displays have limited value in deriving overall conclusions from the simulation, since they are produced only for a sample of airplanes, each being subject to random processes insofar as information in the display is concerned.

b. TRAKAC Change Card - only on aircraft displays

(1) Data Activation/Generation

In order to track a particular aircraft which is processing during the simulation, a user must request the data be generated during the Main Module simulation run by using the TRAKAC change card. The user enters the aircraft tail-number (TRN) or the aircraft

sequence number on the TRAKAC card. These numbers are obtained from the Aircraft Identity Dictionary printed in the Main Module run. The TRN of the Aircraft Identity Dictionary can only be used if the TRAKAC card replaces another TRAKAC card and no other change cards are added or deleted. If both the DSPLAY and TRAKAC cards are used then the first kind read will be implemented and all the change cards of the second kind will be ignored.

CAUTION: If the tracking of a desired aircraft is begun after the aircraft is processing any task in the network, then the tail number is not available to be printed on the display. This is due to the fact that the aircraft tail number is tapped out upon aircraft assignment, prior to processing any task. The number printed will be the tail number of the previously displayed aircraft or zero. All subsequent displays for this aircraft with future assignments will print the proper tail number.

(2) General Description

The General Description for the DSPLAY change card in this section of the text also applies to the TRAKAC change card. However, only the tasks with the symbols V, F, S, and U are displayed when using the TRAKAC card. Refer to the Tail-Number-Tracking feature description of Chapter IV for a complete description of how aircraft are tracked.

```
83384
    12.4292     73582      73 12.4773       2
    12.4773     73582      28 12.4773       5
    12.4773     73726      22 12.4773       5
    12.4773     73726      28 12.4773       5
    12.4773     73582      22 12.4773       5
    12.4773     73582      82 12.5138       2
    12.5138     72714       2 12.5262       3
    12.5542     72726       3 12.5879       1
    12.5879     72762       5 12.5879       5
    12.5879     72546       4 12.5956       3
    12.5958     72898       6 12.6316       3
    12.6316     72254      47 12.6431       2
    12.6316     72298      25 12.6538       2
    12.6536     72192      26 12.6634       2
    12.6439     72828      48 12.6817       2
    12.6817     82884      58 12.6982       2
    12.6982     72248      51 12.7339       2
    12.7339     72216      52 12.7489       2
    12.7489     72678      53 12.7489       2
TENTH=124 HUNDREDTH=    2 BASE=     1240
```

S-10

```
                                    *A/C NO.    83384 DISPLAY ON DAY   12

.         .         .         .         .         .         .         .         .         .         .         .
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678
  UUUUUU
       V
       V
       V
       V
       UUUUU
           SS
                FFFF
                   V
                   SS
                    SSSSS
                         UU
                         UUU
                         UUUUU
                          UU
                             UU
                              UUUUU
                                  UU
                                   J
```

TASK WUC	STOP TIME	NO. PREM
DL.MIS	12.48	0
HMODE6	12.48	0
DCMIS2	12.48	0
HMODE6	12.48	0
DCMIS2	12.48	0
UL.BMS	12.51	0
PRELCH	12.53	0
SORTIE	12.59	0
BCRMNT	12.59	0
FUEL	12.59	0
POSFLT	12.63	0
CMDISP	12.64	0
TSHOUT	12.65	0
CMTSHT	12.66	0
HNREP1	12.66	0
REMVC1	12.70	0
BCHKC1	12.73	0
TRANC1	12.74	0
REPLC1	12.74	0

FIGURE 5-5. DISPLAY POST PROCESSOR SAMPLE OUTPUT

```
      16.0000    79140      3 16.1169       1
      16.1169    71660      5 16.1169       5
      16.1695    80714      4 16.1766       3
      16.1766    81042      6 16.2194       3
      16.2194    81270     47 16.2316       2
      16.3333    78162     48 16.3451       2
      16.3451    80224     50 16.3653       2
      16.3451    81042     49 16.3454       2
      16.3653    79270     51 16.4107       2
      16.4208    72898     52 16.4290       2
      16.4290    79434     53 16.4290       2
TENTH=160 HUNDREDTH=    0 BASE=     1600
```



```
                                  *A/C NO.    83304 DISPLAY ON DAY   16

.         .         .         .         .         .         .         .         .         .
0         1         2         3         4         5         6         7         8         9         0
01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
FFFFFFFFFFFF
           V
         SS
          SSSSS
              UUU
                                  III
                                  UUU
                                  UUU
                                    UUUUUU
                                         U
                                         U
```

TASK WUC	STOP TIME	NO. PREM
SORTIE	16.12	0
DCRMNT	16.12	0
FUEL	16.18	0
POSFLT	16.22	0
CMDISP	16.23	0
CMTSHT	16.35	0
REMVC1	16.37	0
CMMNRP	16.37	0
BCHKC1	16.41	0
TRANC1	16.43	0
REPLC1	16.43	0

FIGURE 5-5. DISPLAY POST PROCESSOR SAMPLE OUTPUT (CONT'D)

3. MATRIX POST PROCESSOR

a. Data Activation/Generation:

In order to obtain manpower matrices, the data must first be requested in the Main Module Change Card file with a SWICH (12) card. By making SWICH = 1, 2, or 3 various amounts of manpower matrix data will be produced. See Chapter VII, Change Card Specification, for the details on the SWICH parameters.

Once the data is on the Main Module output data file, the Decoder will produce two files - one BCD file containing the Manpower Matrix data records and one binary file containing the Matrix dictionary. The Matrix sort program sorts all records pertaining to a work center together, so that all matrices for a given work center will appear together on the MATRIX output.

The work center name is the only identifier required to obtain the matrices for that work center since the resource dictionary of all resources is passed to the Matrix Post Processor from the Decoder. However, additional work center input data is necessary. See Chapter IV, Program SPEC Cards, Matrix Portion, for details.

b. General Description

The Matrix Post-Processor includes two programs - a Sort program and the Matrix simulation program itself.

The sort program sorts the merged records by work center, record type, and time. Record types include on-equipment or off-equipment in-process records, on-equipment backorder records, and off-equipment backorder records.

The Matrix Post Processor has been written as a dynamic simulation to provide better flexibility and accuracy. However, it does display and summarizes actual demands for manpower for each given manpower specialist (work center).

There are three types of manpower matrices. The on-equipment and off-equipment in-process data have been combined into one matrix for display purposes but their statistical summaries are presented separately as shown in Figure 5-6. The on-equipment backorder and off-equipment backorder matrices are available separately, and each contains, besides the statistical summaries, three graphs - one based on number of men backordered as primes in excess of the on-hand balance, one based on number of tasks in backorder waiting for the resource as a prime resource, and one based on number of tasks in backorder waiting for the resource as a substitute resource.

Except for the number of tasks in backorder graph, each matrix graph is a time-oriented display that shows on how many days what the maximum number of men working or backordered simultaneously was by half-hour.

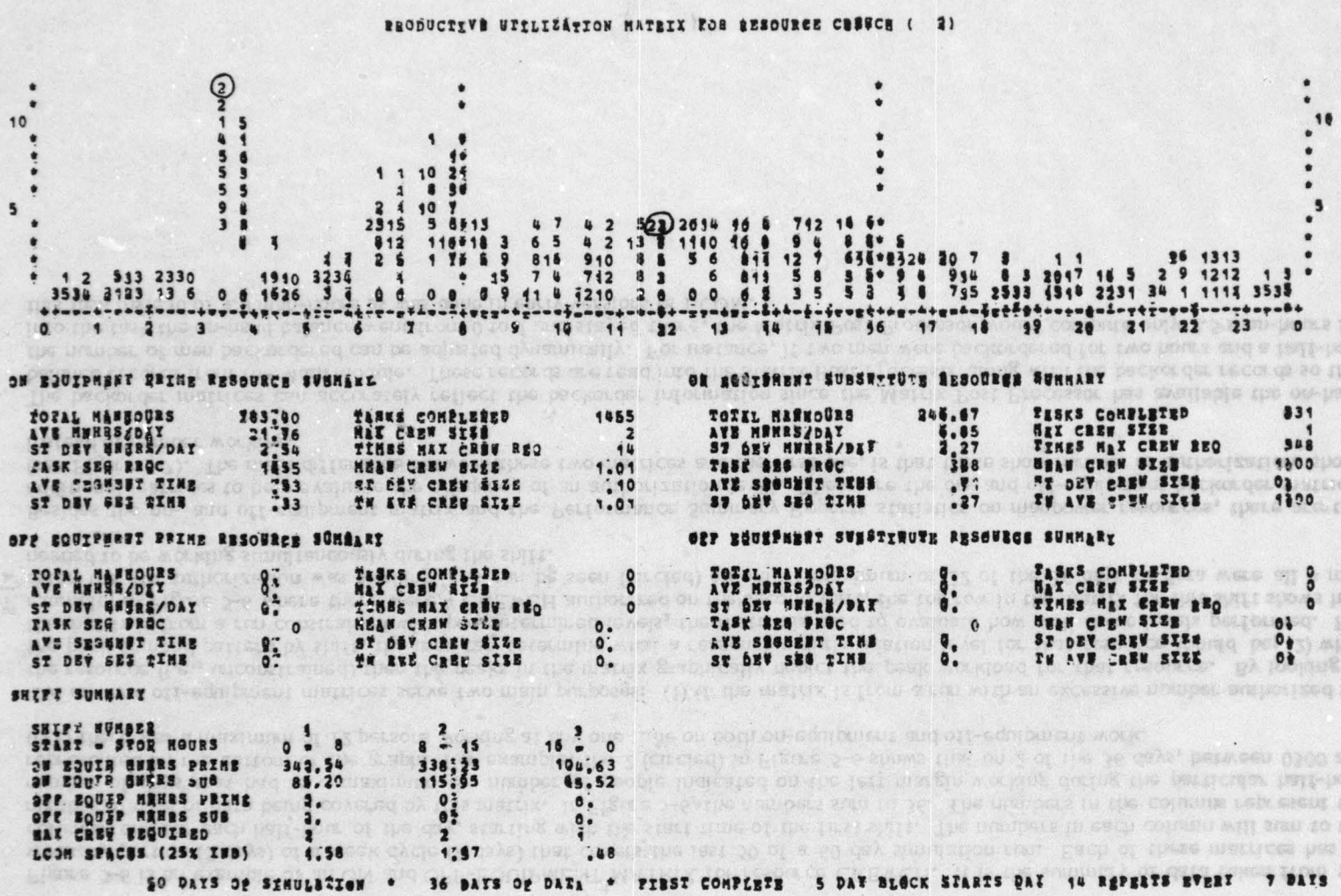


FIGURE 5-6. MATRIX POST PROCESSOR SAMPLE IN-PROCESS OUTPUT

The period of days being covered by the Matrix Post Processor is divided up into repetitive cycles each of which can consist of up to 3 blocks of days. For example, if weekday data is to be presented separately in the matrices from weekend data, you could specify in the Matrix Spec Card that the number of blocks equals 2, block 1 equals 5 days, and block 2 equals 2 days. The Matrix Post Processor would then automatically break up the input data into 7 day cycles consisting of 5 days followed by 2 days starting the first cycle at day 0.

The maximum number of shifts for a particular block of a work center is 8. However, a restriction exists in that the first shift of every block of the same work center must have the same starting time.

Figure 5-6 is an example of an ON and OFF-EQUIPMENT MATRIX for resource CREWCH. It is the summary of data taken from the weekday portion (5 days) of a week cycle (7 days) that covers the last 50 of a 60 day simulation run. Each of these matrices has 48 columns, one for each half-hour of the day, starting with the start time of the first shift. The numbers in each column will sum to the number of days of data being covered by this matrix. In Figure 5-6, the numbers sum to 36. The numbers in the columns represent the number of days that had as a maximum the number of people indicated on the left margin working during the particular half-hour represented on the bottom of the graph. For example, the 2 (circled) in Figure 5-6 shows that on 2 of the 36 days, between 0300 and 0330 there was a maximum of 12 persons working at any one time on both on-equipment and off-equipment work.

The on- and off-equipment matrices serve two main purposes: (1) if the matrix is from a run with an excessive number authorized for the resource (i.e., unconstrained) then the peaks in the matrix graphically depict the peak workload for that resource. By looking at the peak demand pattern by shift, the user can determine what a reasonable authorization level for that resource should be; (2) when the matrix is from a run constrained with pre-determined levels, the matrix is used to evaluate how well these levels performed. For example, in Figure 5-6 where there were 4 CREWCH authorized on the second shift, the top row in the matrix for this shift shows how often the 4th authorization was working. As can be seen (circled) on only a maximum of 22 of the 36 days of data were all 4 men needed to be working simultaneously during the shift.

Besides the on- and off-equipment matrix and the Performance Summary Reports statistics on manpower resources, there are two additional matrices to help evaluate the adequacy of an authorization level. These are the on- and off-equipment backorder matrices (see Figure 5-7). The main difference between these two matrices and the first one, is that these show number of authorizations short, instead of number working.

The backorder matrices can accurately reflect the backorder information since the Matrix Post Processor has available the on-hand balance records from the Main Module. These records are read into the Matrix Post Processor along with the backorder records so that the number of men backordered can be adjusted dynamically. For instance, if two men were backordered for two hours and a half-hour into the task the on-hand balance went from 0 to 1 and stayed there, the Matrix Post Processor would compute only 2.5 man-hours for this task instead of 4.0 man-hours as was done in early versions of LCOM.

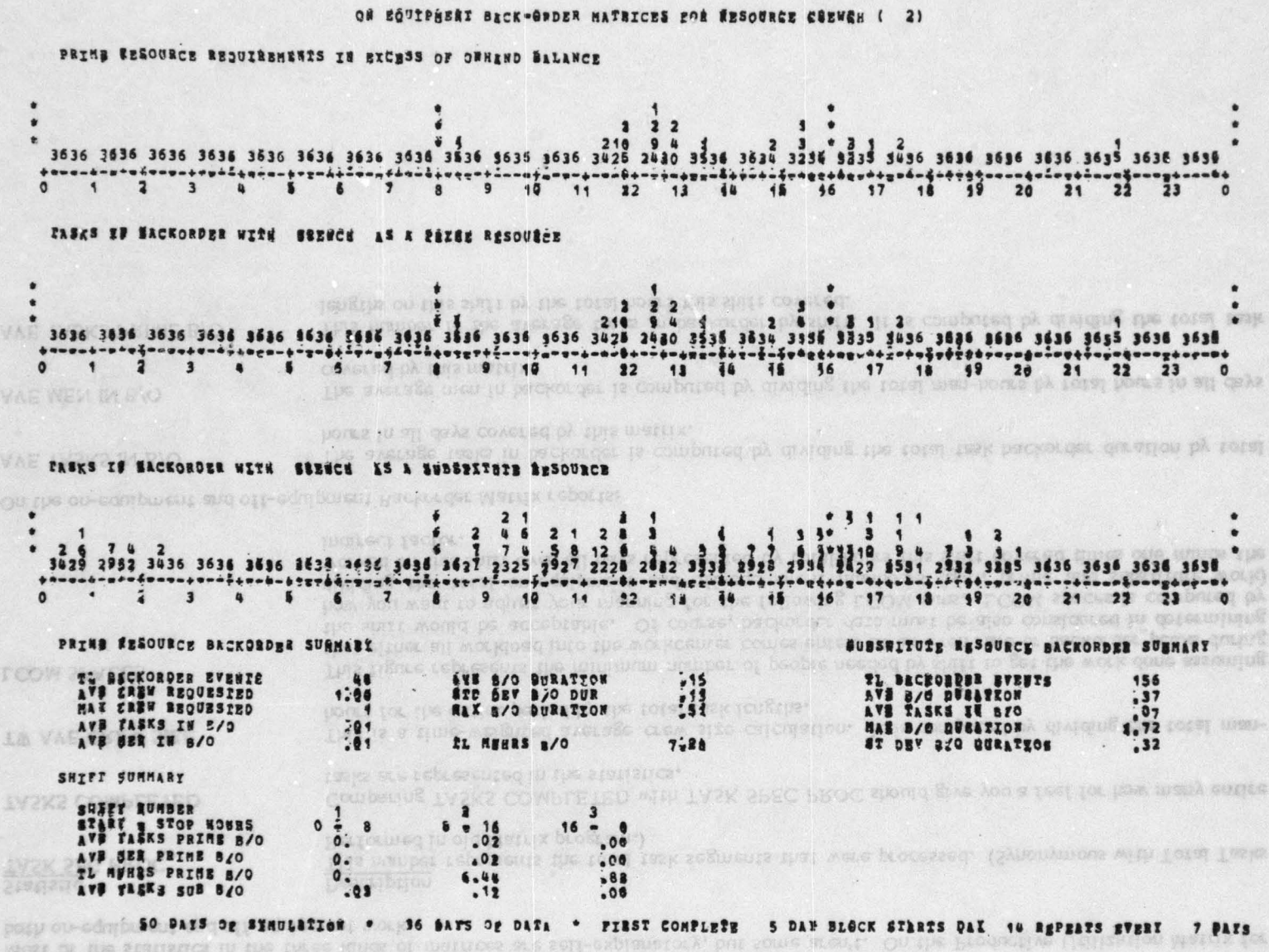


FIGURE 5-7. MATRIX POST PROCESSOR SAMPLE BACKORDER OUTPUT

Most of the statistics in the three kinds of matrices are self-explanatory, but some aren't. On the Productive Utilization Matrix for both on-equipment and off-equipment work:

Statistic	Description
TASK SEG PROC	This number represents the total task segments that were processed. (Synonymous with Total Tasks Performed in old Matrix program.)
TASKS COMPLETED	Comparing TASKS COMPLETED with TASK SPEC PROC should give you a feel for how many entire tasks are represented in the statistics.
TW AVE CREW SIZE	This is a time-weighted average crew size calculation. It is computed by dividing the total man-hours for the entire period by the total task lengths.
LCOM SPACES	This figure represents the minimum number of people needed by shift to get the work done assuming that either all workload into the workcenter comes enters at an even rate or backorder peaks during the shift would be acceptable. Of course, backorder data must be also considered in determining how you want to adjust your manning for the following LCOM runs. LCOM spaces is computed by dividing the total on-equipment and off-equipment manhours (both prime and substitute work) worked on this shift over all days represented by total hours this shift covered times one minus the indirect factor.

On the on-equipment and off-equipment Backorder Matrix reports:

AVE TASKS IN B/O	The average tasks in backorder is computed by dividing the total task backorder duration by total hours in all days covered by this matrix.
AVE MEN IN B/O	The average men in backorder is computed by dividing the total man-hours by total hours in all days covered by this matrix.
AVE TASKS PRIME B/O	This number is the average tasks in backorder by shift. It is computed by dividing the total task lengths on this shift by the total hours this shift covered.

4. PARTS POST PROCESSOR

a. Special Main Module Interfaces

(1.) New task types

Two task types are included on the Form 12 input form to aid in producing the proper parts data records that will be read by the Parts Post Processor. These task types are:

(a) Type 6 - Used to define a parts condemnation task used within the parts networks.

(b) Type 7 - Used to define the First Base task in the parts networks. This task type is equivalent in all respects to the type 2 except that it is needed for post processor action. Within the model, it is treated like a type 2 task. This type is the base equivalent of type 4 used to define the first Depot task.

(c) Use of these two types is mandatory when the Parts Post Processor is to be used. However, it will not be necessary to change old data bases if this post processor is not used; the simulation model will run properly but not produce the proper part records as output.

(2) Part network construction

To use the Parts Post Processor, the part network must be described in a specific way. The most general form of this part network is shown below in figure 5-8.

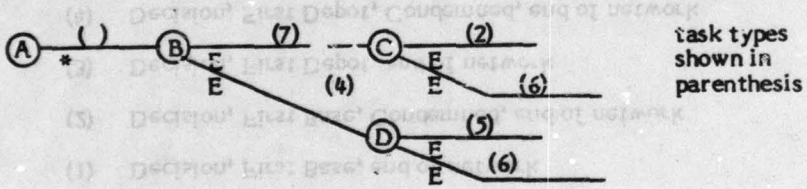


FIGURE 5-8. GENERALIZED PART NETWORK

The network branch from node A to B contains a part generation (*) task. This task can be a type 2 (unscheduled), 3 (scheduled), or 5 (delay). This and all subsequent tasks prior to a type 7 (first base) or type 4 (first depot) will be collected by the Parts Post Processor as Base Decision Time.

To be a valid post processor record, a part must process through either a type 7 or a type 4 task before reaching end of network. Between the * and end of network for the part, there must be one (and only one) type 7 or type 4 task. All base collected statistics are measured from the beginning of the type 7 task to the end of network; depot statistics likewise with a type 4 task. In the example, the top network branch (between nodes B and C) begins the Base portion of the part network and the task is coded type 7 (new procedure). Conversely, the bottom branch (between nodes B and D) begins the depot portion of the network and the task is coded type 4 (no change to current procedure). Processing subsequent to node C will either remain Base Repair, type 2 (3 or 5), or Base Condemned, type 6. On the Depot portion of the network subsequent to node D, processing will either remain in a Depot delay status, task type 5 or Depot condemned type 6.

In summary, requirements are that a part process one of the following sequence of tasks as a minimum and the network should be constructed accordingly to permit this processing:

(1) Decision, First Base, end of network

(2) Decision, First Base, Condemned, end of network

(3) Decision, First Depot, end of network

(4) Decision, First Depot, Condemned, end of network

Note: In all the above valid cases, the decision task is optional, the generate (*) can be placed on the First Base and First Depot tasks.

Caution: Networks cannot be constructed with a type 7 (first base) on tape 4 (first Depot) in sequential order. Main module runs will abort. The reverse is also true.

b. Data Activation/Generation

To cause the data to be generated for post processor usage, a change card PARTSP must be used. The time to begin collecting this data can be specified on the change card. See Chapter VII, Change Card Specifications, for format and parameters. The Parts Post Processor would then be exercised using this output data as processed through the Transaction Decoder Program. This data was converted to BCD and requires a SORT prior to post processor processing.

A record is generated for every task processed that consumes a part. A second record is generated at the end of the part disposition network. If the Main Module is stopped on a particular day, all part disposition networks in process will not have completed and there will be less part completion records than part consumption records. This must be taken into account when analyzing the Part Post Processor outputs. An alternative method to insure equal numbers of completion and consumption records would be to process only a specified number of days of a flying program, but permit the simulation to continue internally generated network processing until all is complete. This can be accomplished by generating only that specific number of days of exogenous records and making the STOP change card 35-40 days longer.

PART NUC	STANDARD STATISTICS			BASE STATISTICS			DEPOT STATISTICS	
	UNIT COST	NO. DEMANDS	# DAYS STOCK OUT	NO. REPAIRED	MAX CYCLE TIME	NO. REPAIRED	MAX CYCLE TIME
	AUTHORIZED LEVEL	AVG DAILY DEMAND	# DAYS BACKORDER	NO. CONDEMNED	AVG CYCLE TIME	NO. CONDEMNED	AVG CYCLE TIME
	AVG QUAN ON HAND	DEMDS NOT SATIS.	BACKORDER RATE	CONDEMNED RATE	STD DEV C-TIME	CONDEMNED RATE	STD DEV C-TIME
	MIN QUAN ON HAND	TIME BETWN DEMDS		AV DECISION TIME		BASE NRTS RATE	
PUMPH1	$ 100.00	17	.774320	14	2.009697	3	13.104676
	3	.2833	0.	0	1.222523	0	8.766703
	2.2780	0	0. %	0. %	.691960	0. %	6.073847
	0	5.460900		.022971		17.647 %	
PUMPH2	$ 100.00	72	17.660836	63	3.262636	8	31.205492
	6	1.2000	9.115017	0	2.011385	0	19.258563
	.8991	19	26.389 %	0. %	.531013	0. %	7.294035
	0	.829196		.013970		11.268 %	
RDASSY	$ 1000.00	1042	31.916332	1041	2.605135	0	0.
	4	17.3667	25.869190	0	.280815	0	0.
	1.2459	543	52.111 %	0. %	.508694	0. %	0.
	0	.057637		.010786		0. %	
RADC11	$ 500.00	664	20.721079	465	.113637	199	34.655184
	65	11.0667	17.555138	0	.075161	0	20.334127
	-1.5247	206	31.024 %	0. %	.011716	0. %	5.737467
	0	.090473		.012016		29.970 %	
RADC12	$ 500.00	706	35.340652	588	.100838	118	38.897433
	37	11.7667	31.617378	0	.073671	0	19.862954
	-.5366	389	55.099 %	0. %	.005776	0. %	6.695697
	0	.085031		.011229		16.714 %	
BMS500	$ 1000.00	3336	0.	268	0.	3070	.000002
	9999	55.6000	0.	0	0.	0	.000000
	9368.6195	0	0. %	0. %	0.	0. %	.000001
	9273	.017756		.000000		92.192 %	
SMTBMS	$ 18000.00	1200	0.	0	0.	1200	.000002
	9999	20.0000	0.	0	0.	0	.000000
	9757.1996	0	0. %	0. %	0.	0 %	.000000
	9735	.049215		.000000		100.000 %	
MISSLS	$ 14000.00	420	0.	122	0.	279	.000002
	999	7.0000	0.	0	0.	0	.000000
	927.4193	0	0. %	0. %	0.	0. %	.000001
	844	.140926		.000000		69.576 %	
CAMERA	$ 2600.00	111	0.	116	.095767	0	0.
	20	1.8500	0.	0	.064131	0	0.
	23.4335	0	0. %	0. %	.008476	0. %	0.
	20	.539015		0.		0. %	

FIGURE 5-9. PARTS POST PROCESSOR SAMPLE OUTPUT

c. General Description

A sample output of this post processor is shown in Figure 5-9. The entire set of statistics are printed by specific part identity. The titles above each column are in the respective order (top to bottom) that the statistic result is printed. All statistic time values are in days.

The first 3 columns (11 statistics) are considered standard or consumption related statistics. The 4th and 5th columns (7 statistics) are base related and the last two columns (7 statistics) are depot related.

The sum of the base repairs and depot statistics - Number Repaired and Number Condemned, should equal the standard statistic - Number Demands when all internal processing is complete. This will be accomplished only when the flying program ends and the simulation continued till completion. In most instances, this will probably not be the case unless users make a specific effort to force this situation.

Also note that when all internal processing is not complete (and depot cycles are the longest) the base NRTS rate will probably reflect a lower stat value than that of the Main Module Performance Summary Report: NRTS statistics. This is due to the simulation computing this stat when the part enters the depot cycle which is often immediately and the Parts Post Processor records being triggered at the end of the post network. This condition will also be corrected if all internal processing is completed.

5. MISSION POST PROCESSOR

The Mission Post Processor processes the RFS data reformatting it to one line per sortie to produce the Chronological Sortie History Report and then summarizes it to produce the Mission Success Statistical Report at user specified intervals.

a. Data Activation/Generation

The Mission Post Processor uses the RFS data produced by the Transaction Decoder. This data must first be requested in the Main Module Change Card file by using the SWICH (9) change card. See Chapter VII, Change Card Specifications, for card format and parameters. Refer also to Section F, this chapter, for the RFS Data description. Subsequent to the Main Module run, the Transaction Decoder will place the RFS data on a separate file if the RFS or RF3P Spec card option is used.

b. General Description

The Mission Post Processor accumulates for each sortie, the RFS data type 12 records, the Aircraft Request Records, and the Completion Records (type 13 or type14) and outputs this data as a single line in the Chronological Sortie History Report. A sample report is found in Figure 5-10. This report data field is described in Table 5-2. The applicable mission problem codes are shown in Table 5-1. These codes are related to the RFS problem codes of Table 5-9 and the aircraft activity processing codes of Table 5-7 .

In addition to the Chronological Sortie History Report, the Mission Post Processor Program accumulates Mission Success Statistics into a report output at user chosen intervals. A sample report is found in Figure 5-11and its data fields are described in Table 5-3. The Mission Success Statistics Reports summarize the missions by name, scheduled take-off, time of day, max and min aircraft to be flown. An additional part of this report is by mission name only. These statistics are comparable to the PSR Operations statistics.

Each report can be output to a different file so that either may be suppressed. See in Chapter VI, the Mission Post Processor SPEC card.

TABLE 5-1. MISSION PROBLEM FLAGS AND DESCRIPTIONS

RFS Code	Rec Type	MSS Flag	Problem Description
0	13	(blank)	(blank)
1	13	A	ATTRITION
3	13	R	RAM REPAIR
4	13	X	AIR ABORT
-4	13	Y	SYMPATHETIC ABORT
7	14	G	GROUND ABORT
8	14	M	MAINTENANCE NON-DELIVERY
9	14	S	SYMPATHETIC GROUND ABORT
10	13	E	SPARE NOT USED
11	13	F	FUNCTIONAL CHECK FLIGHT
4	12	(blank)	NORMAL ACTIVITY
3	12	Z	ALERT REPLENISHMENT
2	12	W	WEATHER CANCEL
7	14 & 11	M	MND FILL BY TAIL NNNNNN
8	14 & 11	G	REPLACED BY TAIL NNNNNN

TAIL NUMBER	FRAG TIME	MISSION NAME	SCHED TAKEOFF	F W P FLAGS	TAKEOFF TIME	CANCEL TIME	PROBLEM FLAGS	PROBLEM DESCRIPTION	LANDING TIME
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
	28.125	PREFLT	28.125	0				NORMAL ACTIVITY	
83288	28.133	RECON	28.250	0 0 0	28.250				28.292
83480	28.133	RECON	28.250	0 0 0	28.250				28.292
83320	28.175	INTRD3	28.292	0 0 0	28.292				28.334
83160	28.212	CLSPT2	28.333	0 0 0	28.333				28.389
83456	28.212	CLSPT2	28.333	0 0 0	28.333				28.389
83192	28.212	CLSPT2	28.333	0 0 0	28.333				28.389
83256	28.212	CLSPT2	28.333	0 0 0	28.333				28.389
83272	28.250	INTRD1	28.354	0 0 0	28.354				28.381
83304	28.250	INTRD1	28.354	0 0 0	28.354				28.381
83240	28.250	INTRD1	28.354	1 0 0		28.354	G	GROUND ABORT	
83224	28.300	RECON	28.417	0 0 0	28.417				28.459
83352	28.300	RECON	28.417	0 0 0	28.417				28.459
83384	28.333	FERRY1	28.438	0 0 0	28.438				28.494
83240	28.417	INTRD1	28.521	0 0 0	28.521				28.595
83480	28.417	INTRD1	28.521	0 0 0	28.521				28.595
83272	28.417	INTRD1	28.521	1 0 0		28.521	E	SPARE NOT USED	
83416	28.429	CLSPT1	28.554	0 0 0	28.554				28.579
83444	28.429	CLSPT1	28.554	0 0 0	28.554				28.579
83176	28.429	CLSPT1	28.554	0 0 0	28.554				28.579
83336	28.475	INTRD2	28.583	0 0 0	28.583				28.649
83160	28.475	INTRD2	28.583	0 0 0	28.583				28.649
	28.475	INTRD2	28.583	1 0 0		28.583	M	MAINTENANCE NON-DELIVERY	
83224	28.508	RECON	28.625	0 0 0		28.656	S	SYMPATHETIC GROUND ABORT	
83272	28.508	RECON	28.625	1 0 0		28.656	G	GROUND ABORT	
	28.508	RECON	28.625	1 0 0		28.656	M	MAINTENANCE NON-DELIVERY	
83344	28.550	RECON	28.667	1 0 0	28.685				28.706
83352	28.633	RECON	28.750	1 0 0	28.750				28.771
83272	28.717	RECON	28.833	0 0 0	28.833				28.854
83224	28.800	RECON	28.917	0 0 0	28.917				28.938
83144	28.896	FERRY2	29.000	0 0 0	29.000				29.063

FIGURE 5-10. CHRONOLOGICAL SORTIE HISTORY REPORT SAMPLE - SP3.5

TABLE 5-2. CHRONOLOGICAL SORTIE HISTORY REPORT DESCRIPTION

Column Heading	Description of Data Entry
TAIL NUMBER	The internal six digit identifier is provided for tail number tracking purposes. This field is presently blank for activities.
FRAG TIME	The time (in days) that pre-sortie processing was scheduled to begin.
MISSION NAME	The six character name from the exogenous events file record which scheduled this sortie.
SCHED TAKE-OFF	The time (in days) that this sortie was scheduled to take off.
F W P FLAGS	Flags to indicate the following events In the "F" column 1 indicates that there was no A/C in the available aircraft pool at frag time that met the requirements in the aircraft assignment search patterns for this mission type. 0 indicates that an aircraft was available and was scheduled for this sortie. In the "W" column 1 indicates that a weather delay was incurred. 0 indicates that there was no delay due to weather. In the "P" column 0 indicates no plug occurred for this sortie. 1 indicates the aircraft (or lack of one) for this scheduled sortie was replaced by a cocked aircraft. 2 indicates that this is the replacement aircraft.
TAKE-OFF TIME	The time (in days) that this sortie actually took off. This applies to air aborts, attrition, RAM or FCF in addition to normal sorties with no problem.
CANCEL TIME	The time (in days) that this sortie was cancelled. This applies to ground aborts, sympathetic ground aborts, maintenance non-deliveries and spares not used.
PROBLEM FLAG	See Table 5-1.
PROBLEM DESCRIPTION	See Table 5-1.
LANDING TIME	The time (in days) that this sortie finished. This applies only to sorties with no problems.

MISSION SUCCESS STATISTICS RUN NUMBER SP3.5C PAGE 42

LEVEL 1 REPORT FROM 20.0 TO 30.0

MISSION IDENT	TIME SCHED	SIZE MAX	SIZE MIN	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	NO ACFT AT PCT	TAKEOFF LATE	TAKEOFF PCT
PREFLT	300	11	0	2	2	1.000	22	22	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	13	0	3	3	1.000	39	39	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	14	0	3	3	1.000	42	42	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	15	0	1	1	1.000	15	15	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	16	0	1	1	1.000	16	16	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	600	2	2	10	10	1.000	20	20	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRD3	700	1	1	10	10	1.000	10	10	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	800	4	3	10	10	1.000	40	40	1.000	0	0	0	0	0	0	0	0	0	0	0.
INTRD1	830	2	2	10	10	1.000	20	20	1.000	2	5	0	0	0	0	3	3	.150	4	.200
RECON	1000	2	2	10	10	1.000	20	20	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY1	1030	1	1	10	10	1.000	10	10	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRD1	1230	2	2	10	9	.900	20	18	.900	1	6	1	0	0	0	4	7	.350	2	.111
CLSPT1	1320	3	2	10	10	1.000	30	28	.933	0	2	0	0	0	0	0	8	.267	0	0.
INTRD2	1400	2	2	10	2	.200	20	4	.200	19	3	4	0	0	0	0	25	1.250	0	0.
RECON	1500	2	2	10	3	.300	20	6	.300	10	8	6	0	0	0	0	29	1.450	4	.667
RECON	1600	1	1	10	9	.900	10	9	.900	0	1	0	0	0	2	0	10	1.000	6	.667
RECON	1800	1	1	10	10	1.000	10	10	1.000	0	0	0	0	0	0	0	2	.200	3	.300
RECON	2000	1	1	10	10	1.000	10	10	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2200	1	1	10	10	1.000	10	10	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY2	2400	2	2	9	5	.556	13	10	.556	6	0	2	0	0	1	0	7	.389	2	.200

MISSION SUCCESS STATISTICS RUN NUMBER SP3.5C PAGE 43

LEVEL 1 SUMMARY REPORT FROM 20.0 TO 30.0

MISSION IDENT	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	DAYLIGHT SORTIES ATTD	DAYLIGHT SORTIES PCT	DAYLIGHT SORTIES FLOWN	DAYLIGHT SORTIES PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	NO ACFT AT PCT	TAKEOFF LATE	TAKEOFF PCT
PREFLT	10	10	1.000	134	134	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.
RECON	70	62	.886	100	85	.850	70	.700	55	.647	10	9	6	0	0	2	0	41	.410	13	.153
INTRD3	10	10	1.000	10	10	1.000	10	1.000	10	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	10	10	1.000	40	40	1.000	40	1.000	40	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRD1	20	19	.950	40	38	.950	40	1.000	38	1.000	3	11	1	0	0	0	7	10	.250	6	.158
FERRY1	10	10	1.000	10	10	1.000	10	1.000	10	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT1	10	10	1.000	30	28	.933	30	1.000	28	1.000	0	2	0	0	0	0	0	8	.267	0	0.
INTRD2	10	2	.200	20	4	.200	20	1.000	4	1.000	19	3	4	0	0	0	0	25	1.250	0	0.
FERRY2	9	5	.556	18	10	.556	0	0.	0	0.	6	0	2	0	0	1	0	7	.389	2	.200

FIGURE 5-11. MISSION SUCCESS STATISTIC REPORT SAMPLE - SP3.5

TABLE 5-3. MISSION SUCCESS STATISTICS REPORT DESCRIPTION

Column Heading	Description of Data Entry
MISSION IDENT	The six character mission name passed through from the exogenous data file.
TIME SCHED	The fractional part of SCHED TAKE-OFF converted to hours (HH) and minutes (MM) and written as HHMM.
SIZE	The maximum and minimum number of aircraft to accomplish the mission.
MISSIONS	The number of times this mission was attempted (ATTD), flown (FLOWN), and the decimal fraction of the attempted that were flown (PCT).
SORTIES	Similar to missions.
SORTIES LOST TO	The number of sorties lost to maintenance non-delivery (MND), ground abort (GAB), sympathetic ground abort (SAB), and other causes (OTH).
AIR ABT	The number of sorties which resulted in attrition, RAM repair, air abort, and sympathetic air abort.
PLUGS	The number of RFS type 11 records associated with the mission.
SPARES	The number of spares prepared but not flown for this mission.
NO ACFT AT FRAG	The number of times pre-sorties processing was scheduled to start for this mission but no aircraft was available. Also expressed as the decimal fraction of the sorties attempted.
TAKE-OFF LATE	The number of sorties for this mission which took off after scheduled take-off time. Also expressed as the decimal fraction of the sorties flown.

6. Support Equipment Post Processor

a. Data Activation/Generation:

In order to obtain the support equipment graphs the data must first be requested in the Main Module change card file with a SUPONF card. The turn on and turn off times are to be specified on the card. See Chapter VII, Change Card Specifications, for the details.

The items to be graphed by the Support Equipment post processor must have been defined as resource type "A" (age or facility) on the Form 13, Resource Definitions, to the Input Module.

Once the data is on the Main Module output data file, the Decoder will produce a BCD file containing the Support Equipment data records in a format acceptable to the Fortran version of this post processor as well as the sort package for the Support Equipment post processor. See Table 5-4. The sort will produce a file of all the records sorted by resource ID, then by equipment code, then by start time.

The user must supply the resource ID assigned by the Input Module to this piece of support equipment in order to obtain the graphs. This resource ID number can be found by examining the Resource Dictionary produced by the Input Module.

b. General Description

The Support Equipment post processor includes two programs - a Sort program and the Support Equipment simulation program itself.

The Sort program utilizes the standard sort package available on each machine to sort the records by resource ID, then by equipment code (ON- or OFF-EQUIPMENT), and then by task starting time.

The Support Equipment post processor has been written as a dynamic simulation to provide improved accuracy and to reduce the execution time.

There exists a need for this post processor due to the conflict between the manner the Main Module models the support equipment and the real world situation. In the real world a piece of support equipment may be used by several tasks on an aircraft simultaneously. There is usually no more pieces of this item physically located with an aircraft at any given time than the maximum number required by a single task. Since the Main Module does not model the multiple use of a single resource, the Main Module cannot accurately model the real world for support equipment. Instead each demand is satisfied with a draw from supply. This procedure inflates the required pieces of support equipment as shown in the Performance Summary Reports.

The Support Equipment post processor has been written to eliminate these unnecessary or redundant draws from supply. For each equipment code within each desired resource ID, two graphs are produced. The first graph represents the demands for the support

equipment items as modeled in the Main Module. See Figure 5-12. The second graph depicts the real world demands by eliminating the redundant demands. See Figure 5-13.

Each graph whether model or actual is a time-oriented display that shows on how many days what the maximum number of support equipment items simultaneously busy was by half hour interval, much as the Matrix post processor displays its output.

There are seven statistics provided by the Model demands. Four of these are also printed for the Actual demands. The average and maximum requested would be the same for both graphs. The average task segment duration has no bearing on actual demands and is therefore not calculated.

TABLE 5-4. SUPPORT EQUIPMENT DATA RECORDS

VAR NAME	DESCRIPTION	FORMAT
IRC	RECORD TYPE 1 = ON EQUIP, 2 = OFF EQUIP	I2
BLANK		1X
IRES	SE RESOURCE NUMBER	I6
BLANK		1X
IPTRN	ITEM THAT THE SE ITEM IS BEING USED ON I.E. FOR ON EQUIP RECORDS, THE AIRCRAFT "TAIL NUMBER"	I6
BLANK		1X
STRT	TIME THE TASK STARTED	F11.5
BLANK		1X
DUR	DURATION OF THE TASK	F11.5
BLANK		1X
IQANTY	QUANTITY OF THE SE ITEM REQUIRED BY THE TASK	I6

```
                    MODEL SUPPORT EQUIPMENTS DEMANDS

                    RESOURCE ID     18   ON -EQUIPMENT

2 +                                                 1 1124  8 1 1515 17 5  9 8 13 6    1  618 1911  618 11 3  4                +2
1 + 2713  2 6  2    6 5  3 2  1                   126 3726 3438 3229 3334 2828 2928 2222 2236 3133 3131 3927 1514 2516  214 +1
0 + 3347 5854 5868 5455 5758 5968 6868 6868 6868 5933 1218 1829 1316 1021 2324 1826 3837 32 6 1816 2319 1038 4146 3544 5846 +0
  +----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+---+
       1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24

TOTAL DEMANDS              1158   AVERAGE DEMANDS PER HOUR          .799   AVERAGE QUANTITY REQUESTED     1.00
TOTAL EQUIPMENT HOURS    194.94   AVERAGE TASK SEGMENT DURATION     .007   MAXIMUM QUANTITY REQUESTED      1
PERCENT OF TIME IN USE     .14
```

FIGURE 5-12. SUPPORT EQUIPMENT MODEL GRAPH

ACTUAL SUPPORT EQUIPMENT DEMANDS

RESOURCE ID 10 ON -EQUIPMENT

```
2 +                                                
```

E. REALIZED FLYING SCHEDULE (RFS) DATA

The Realized Flying Schedule data is used by the mission post processor and several additional programs not currently included in the LCOM II simulation software. However, since these programs exist and the RFS data is used for debug purposes, the data structure itself will be described and no attempt will be made to describe the additional programs. The Realized Flying Schedule(RFS) data includes weather delay, weather cancel, attrition, air abort, sympathetic air abort, RAM and alert replenishment problem codes.

1. Data Activation Generation

To cause the data to be generated on the post processor file, the data must first be requested in the Main Module Change Card file by using the SWICH (9) change card. See Chapter VII, Change Card Specifications, for card format and parameters.

Subsequent to the Main Module run, which places all the post processor data on a single file, the Transaction Decoder program will place the RFS data on a separate file if the RFS or RFSP Spec card option is used.

2. General Description

The actual RFS data will be described since it is used for debug purposes. A sample of the data is found in Figure 5-9. This is a sample only and is not described in this write-up. However, RFS data generation, data interpretation, and analysis information is provided as follows:

Realized Flying Schedule Statistic Implementation

This is an explanation of the RFS file provided by LCOM II only. The Realized Flying Schedule (RFS) file is used as a debug aid and is used as input data to the TACFLIER model for crew ratio studies and several other programs. The RFS output captures the results of every sortie requested in the simulation while SWICH 9 was turned on. The data is presented in the form of RFS Records and Aircraft Records. The RFS Record types are described in Table 5-5.

TABLE 5-5 RFS RECORD TYPES

Record Type	Description
11	"plugged" aircraft
12	Mission/Activity Requests
13	Completion Record - Flew
14	Completion - Cancelled
15	Run Number

The type 12 Mission/Activity Request RFS records are the first records in a logical chain of events during the simulation. They are interspersed throughout the RFS file. One of these records is produced each time a new mission is requested (scheduled to begin processing-fragged) or when an Activity (non-mission processing) of an aircraft is requested (scheduled to begin processing). The data information and format on these type 12 records are described in Table 5-5.

TABLE 5-6 MISSION REQUEST RFS RECORDS

COL	DATA	FORMAT
1	blank	
2-3	'12'	I2
4	blank	
5-11	current (frag) time	XXX.XXX (D7,3)
12-17	total aircraft to process (max & spare)	I6
18-19	blank	
20-27	Max aircraft	I8
28-30	weather delay time (in minutes)	I3
31-33	minimum aircraft to satisfy mission	I3
34-35	blank	
36-43	mission ID	I8

Immediately after each Mission/Activity Request, RFS record (type 12) an individual aircraft record is listed for each aircraft, including spares required to satisfy the mission. These records are listed by an index value in numerical order. This index number is sequential throughout the simulation and is an aid in locating (verifying) additional RFS information about the specific aircraft. Aircraft records data entries and format are described in Table 5-7.

TABLE 5-7 AIRCRAFT RECORD FORMAT

COL	DATA	FORMAT
1-6	index value	I6
7-9	blank	
10-17	request (dummy) tail no	I8
18-20	blank	
21-26	mission name (from EXOG file)	A6
27-32	blank	
33-39	scheduled take-off time	XXX,XXX (D7,3)
40-46	cancel time (delta)	XXX,XXX (D7,3)
47-53	sortie length	XXX,XXX (D7,3)
54-57	blank	
58	flag (0=aircraft assigned at frag time; 1=A/C not assigned at frag time	I1
59-60	processing code	12 see footnotes

Notes:

1. Mission aircraft processing codes; 0 = normal mission processing, 1 = weather delays.

2. Activity aircraft processing codes; 2 = weather cancelled mission (treated as an activity), 3 = alert replenishment, 4 = normal activity processing.

Type 13 and 14 Completion RFS records are interspersed throughout the RFS file. They indicate the status of the aircraft at either actual take-off time (type 13 RFS record) or cancel time (type 14 RFS record). Thus, the type 13 RFS record indicates the aircraft flew and the type 14 record indicates it did not fly or was a spare. Those RFS (type 12) records representing an A/C activity will not have any type 13 or 14 record in the data. Weather cancels for example are input as an activity even though they can be considered a sortie that cancels. Both the type 13 and 14 record have the same format. The data and record format is shown in Table 5-8.

TABLE 5-8 COMPLETION RFS RECORDS (13s and 14s)

COL	DATA	FORMAT
1	blank	
2-3	'13' or '14' (RFS Record type)	I2
4	blank	
5-11	take-off or cancel time	XXX,XXX (D7,3)
12-17	index value (corresponds to col 1-6 of aircraft record)	I6 see footnotes
18-19	blank	
20-27	tail number (real or dummy)	I8
28-30	problem code	I3
31-35	blank	
36-43	mission ID (Col 36-43 of Mission Request Record)	I8 see footnotes

Notes:

The mission ID, Col 34-39, and the index value, Col 12-17, make correlation of this completion record with the originating mission RFS record (type 12) and its subsequent records.

At cancel time, if sufficient cocked aircraft can be directly assigned to a mission to permit its accomplishment (bring the number of ready aircraft up to the minimum), sufficient replacement actions occur. Each replacement is effectively an overschedule and the aircraft is said to be "plugged" into the mission. In this case a type 11 RFS Record is produced with no problem code specified. Also, on this record, Col 12-17 will contain the next sequential aircraft request index. The data and format of the type 11 RFS Record is the same as the type 13 and 14 records except for the problem code being left blank.

Immediately following the type 11 RFS Record will be a type 14 RFS Record with the index value and problem code of the aircraft or aircraft request being replaced by the plugged aircraft. Later in the RFS data file (at take-off or cancel time) a type 13 or type 14 RFS Record will appear with the appropriate problem code and the new aircraft request index of the type 11 RFS Record.

Problem codes listed in columns 26-28 of the Completion Records are defined in Table 5-9.

TABLE 5-9 RFS PROBLEM CODES

Problem Code	Problem Description	Applicable Record Type
0	no problem	13
1	attrition	13
2	does not exist	N/A
3	RAM	13
4	air abort	13
-4	sympathetic air abort	13
5	does not exist	N/A
6	does not exist	N/A
7	ground abort	14
8	maintenance non-delivery	14
9	sympathetic ground abort	14
10	spare aircraft not used	13
11	FCF	13

In summary, at frag time mission request records for all mission and aircraft activities are produced. On the following aircraft Request Records, processing codes 0,1,2,3 or 4 will be listed as appropriate and the completion records will indicate the applicable problem code.

Finally, the decoder program which actually creates the RFS file from output generated by the main module produces a '15' card type at the beginning of the RFS data file followed by a record which gives the run name.

3. Model Operation/Interface with RFS Outputs

As an additional aid to experienced users for debug purposes, the following detailed model operation interfaces with the RFS outputs is provided. If the mission is to fly, '13' records will be produced with a problem code of '0' assigned. If the aircraft is a spare, a problem code of '10' will be assigned. If the aircraft flying the mission is to attrit, go to RAM, or air abort, the 0 problem code is replaced by codes 1, 3, and 4 respectively. Sympathetic air aborts are assigned the problem code '-4'. Whenever a FCF task is accomplished, a 13 RFS Record with a 11 problem code is produced. The weather delay record will have a completion record just like the normal mission processing with the appropriate problem codes (0, 10, 7, 8, 9, etc). If an aircraft assigned to a cancelled mission had a status flag of 40, then the aircraft was ready to fly. Therefore, it is a sympathetic ground abort and the problem code produced is a '9'. Note that aircraft assigned to a cancelled mission cannot have a 60 status flag. Only aircraft that fly have that code. If the aircraft was never assigned (status flag of 0), then the tail no. (Col 20-25) on the completion record is a dummy request tail no. and the problem code (Col 26-28) will be an "8". If the aircraft was assigned but did not reach the sortie task (status flag of 100, 101 or 400), then it is considered a ground abort and is assigned a problem code of '7'. A summary of aircraft Flags and the corresponding problem codes are shown in Table 5-10.

TABLE 5-10 AIRCRAFT STATUS FLAG/PROBLEM CODE RELATIONSHIP

A/C Status Flag	Problem Code	Applicable Completion Record
0	8	14
40	9	14
60	0	13
100	7	14
101	7	14
400	7	14

VI. PROGRAM SPECIFICATION (SPEC) CARDS

A. SPEC CARD REQUIREMENT

Each SIMSCRIPT II Module in the LCOM II Simulation Software utilizes the same overall design for input of user options. A single card or record called the SPEC (specification) card is utilized for this purpose and must be included as the first data record input (on I*, 05, or Card Reader).

Basic user options can be established through use of this SPEC card. The input of each option is free form, that is, the option can be placed anywhere on the card, in any order, but at least one blank character must separate any two options. Only 72 characters of the SPEC record are used and should be of sufficient length to contain all required user options. No additional SPEC card is permitted, however, the Matrix Post Processor, the Mission Post Processor, and the Decoder allows continuation cards to be used.

The general form of the SPEC card has the word SPEC on it first, starting in any column (column 1 is preferable only to provide maximum space on the card for options). Subsequent entries (options) are of the form xxxx=yy. Although spaces are permitted around the = sign, elimination of them is also preferable for space utilization.

B. FILE ASSIGNMENT REQUIREMENTS

Where the option specifies a unit nn which has a default value, a file must be assigned in the Job Control Cards (either the default or the unit specified). Where the option specifies a unit nn and the default is undefined, only the unit nn need be assigned in the control cards when the option and unit are specified by the user.

For all programs, the unit specified can be any number from 1 thru 15 (Honeywell only) with 5 reserved as the card reader (I* or 05 file), and 6 the printer or print file. For both the Input and Main modules (Honeywell version only), file #15 is reserved as an optional print file.

C. SPEC CARD DESCRIPTIONS

The SPEC card for each program and the various options permitted are described as follows: (Tables 6-1 thru 6-11).

TABLE 6-1. INPUT MODULE SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	-
FORM=nn	User forms are input on unit nn.	5
PRNT=15	Processing and editing reports are output to unit 15. See Note.	6
EXOG=nn	Exogenous data (flying program) is output to unit nn in BCD.	0
INIT=nn	Initialization data is output to unit nn in binary.	7
INFO=n	Information flag relating to debug of data;	0
	0 = partial node table (only nodes with error codes)	
	1 = above plus resource, task, failure clock, and control table dictionaries	
	2 = all above plus class table and search pattern table dictionaries	
	3 = all above plus the complete node table	
	4 = all above plus a print of the initialization data	

NOTE: On the Honeywell implementation, unit 15 is the alternate print file reserved for the PRNT option and should not be used as the nn file for the other options. Also use no system FFILE cards with this unit. This is due to the Input Module objects being maintained in absolute (H*) Form.

TABLE 6-2. MAIN MODULE SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	-
CHNG=nn	Change cards are input on unit nn in BCD.	10
PRNT=nn	Processing reports are output on unit nn.	6
INIT=nn	Initialization data is input on unit nn in binary.	7
EXOG=nn	Exogenous Data (flying program) is input on unit in BCD.	5
DUMP=nn	Memory dumps are output to unit nn.	*
POST=nn	All post processor outputs are sent to unit nn in binary. The program does not automatically rewind this file.	4
DATA=nn	The standard print-out of the initialization data will be directed to unit nn. Being a print file no system FFILE card is used.	6**

NOTE: *No default exists for this option. If memory dumps are desired, the option and unit must be entered, and the unit assigned in the JCL. Device must be a tape. Option is invalid on the CDC and ITEL (IBM compatable) computers.

**On the Honeywell implementation, Unit 15 is the alternate print file reserved for the DATA option and should not be used as the nn file for the other options. Also, use no system FFILE cards with this unit. This note applies only when using the MAIN module objects in an absolute (H*) Form.

TABLE 6-3. RESTART MODULE SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	
REST=nn	Restore memory dump tape is on unit nn.	8
CHEK=nn	Checkpoint #nn is to be read prior to restarting simulation	1

TABLE 6-4. DECODER SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as the first entry.	*
GRPH=nn	Graph data in binary is to be output on unit nn. See GRPD.	**
GRPD=nn	Graph data in binary is to be output on unit nn and a dictionary of STAT titles is produced.	**
DPLY=nn	Display data in binary is to be output on unit nn.	**
RFS=nn	RFS (Realized Flying Schedule) data in BCD is to be output on unit nn. See RFSP.	**
RFSP=nn	RFS data in BCD is to be output on unit nn and a listing of the data is produced. Print-out is usually voluminous.	**
SEQ=nn	Support Equipment data in BCD is to be output on unit nn. See SEQP.	**
SEQP=nn	Support Equipment data in BCD is to be output on unit nn and a listing of the data is produced. Printout is usually voluminous	**
PRTS=nn	Parts dictionary data (in binary) is to be output on unit nn.	**
PBCD=nn	Parts BCD data is to be output on unit nn. (Not sorted)	14***
MTRX=nn	Matrix dictionary data (in binary) is to be output on unit nn.	**
MBCD=nn	Matrix BCD data is to be output on unit nn. (Not sorted)	15***
IN =nn	Post Processor data in binary from SIMRUN is input on unit nn.	1
DBUG=n	Additional debug output messages are produced, value may be 1, 2, 3 or 4, where the higher numbers produce the most output.	0

NOTES: *Up to two card can be used to hold the Decoder SPEC options. The first card only must start with the word SPEC and the last card must end with a blank followed by an asterisk (*). Therefore, when only one SPEC card is used, it must also end with the blank followed by an asterisk (*).

**No defaults exist for this option. If a particular output is desired, the option and unit must be entered and assigned.

***These defaults are only effective when the corresponding dictionaries are requested.

TABLE 6-5. DISPLAY POST PROCESSOR SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	-
IN=nn	Input data in binary is on unit nn.	1
DBUG=nn	Additional debug output messages are produced. Value may be 1, 2, 3 or 4, with 4 providing the most output.	0

TABLE 6-6. PARTS POST PROCESSOR SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	-
IN=nn	BCD input unit is on nn. (From SORT)	2
DICT=nn	Dictionary data in binary is on unit nn. (PRTS output of Decoder)	1
COPY=nn	Copy of printed output is placed on unit nn.	*
DAYS=nn	Number of days the simulation was run.	60
DBUG=nn	Additional debug output messages are produced. Values may be 1, 2, 3 or 4, with 4 providing the most volume.	0

NOTE: *Option must be entered if copy is desired, no default unit.

TABLE 6-7. GRAPH POST PROCESSOR SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	-
IN=nn	Input data in binary is on unit nn.	1
DBUG=n	Additional debug output messages are produced. Value may be 1, 2, 3 or 4, with 4 providing the most output and includes all the data point values.	0
DAYS=nn	Necessary if graphs of statistics are desired, number to input is determined by DECODER.	0
FDAY=nn	Necessary if forecasted data is to be graphed, number to input is determined by DECODER.	0
STAT=nn	Required to get any statistics graphs, must be the number of graphs wanted, maximum value can be found as the last entry in the STAT dictionary produced by the DECODER with GRPD option. See Notes * and **.	0
STRT=nnn	The earliest day or starting location of the x-axis on the graphs. See Note ***.	0
STOP=nnn	The latest day or ending location of the x-axis on the graphs. See Note ****.	120

NOTES: * Without any option specified only the histogram of the aircraft post-sortie turnaround time is provided by this graph run. This histogram is provided in all graph runs.

** If fewer than the maximum number of statistics are requested, the specific dictionary numbers of those statistics wanted must be input on one or more cards immediately following the SPEC card. These dictionary numbers must be obtained from the DECODER run with the GRPD option. These numbers are entered on the cards in a free form manner (separated by at least one blank field), and may use as many cards as necessary to input all the required STAT numbers. The last value must be followed by a blank field and an asterisk. For example, if only STAT #6 and 9 are wanted, the SPEC CARD option will be: "STAT=2" and the following card would be: "6 9 *". When all statistics are wanted and if the maximum = 73, the SPEC card option would be: "STAT = 73" and no following card would be used.

*** If the STRT day is not a day a PSR is obtained then the starting location will be set to the next PSR day which is greater than the STRT day. The STRT day must be less than the STOP day.

**** If the STOP day is not a day a PSR is obtained then the ending location will be set to the closest PSR day which is less than the STOP day. The STOP day must be greater than the STRT day.

TABLE 6-8. MATRIX POST PROCESSOR SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	*
IN=nn	BCD input unit is on nn (from sort).	2
DICT=nn	Dictionary input is on unit nn. (MTRX output of Decoder).	1
DBUG=n	Additional debug output messages are produced. Value may be 1-4, with 4 producing the most volume.	0
NUM=nnn	Required; number of work centers for which matrices are requested. See Note ***.	**
STRT=nn	Starting day of matrices. See Note ****.	0
STOP=nnn	Required; stopping day of matrices.	**
NBLK=n	Number of blocks matrices are to be broken up into. For instance, if weekdays are to be computed separately from week-ends, NBLK=2, BLK1=5, BLK2=2. NBLK may be 1, 2, or 3.	1
BLK1=nn	Number of days in block 1. Required if NBLK is greater than 1, else defaults to entire matrix length.	**
BLK2=nn	Number of days in block 2. Required if NBLK is greater than 1.	**
BLK3=nn	Number of days in block 3. Required if NBLK=3.	**

NOTES: * Up to two cards can be used to hold the Matrix SPEC options. The first card must be the only card that starts with the word SPEC and the last card must end with a blank followed by an asterisk (*). Therefore, when only one SPEC card is used, it must also end with the blank followed by an asterisk (*).

** There normally is no default for these entries. If the entry must be made and is not, the run will stop with an appropriate diagnostic message.

*** Because each block of each work center could have different shifts, NUM times NBLK work center cards must follow the SPEC cards.

**** No matter what day you want to see matrices start being produced, the matrix program assumes day 1 of block 1 starts at day 0.0. For example, if you are using NBLK=2, BLK1=5, BLK2=2, STRT=10, the matrix program computes that the data you want to see really starts with the 4th day in the second occurrence of block 1 data.

TABLE 6-9. WORK CENTER DATA CARDS

Information	Description	Justification	Column
Work Center Name	AAAAAA	L	1-6
Block Number	I	-	7
% of Indirect Labor	II	R	8-9
Number of Shifts (Max=8)	I	R	10
Start Time of Shift 1	II	R	11-12
Start Time of Shift 2	II	R	13-14
Start Time of Shift 3	II	R	15-16
Start Time of Shift 4	II	R	17-18
Start Time of Shift 5	II	R	19-20
Start Time of Shift 6	II	R	21-22
Start Time of Shift 7	II	R	23-24
Start Time of Shift 8	II	R	25-26

NOTE: Shift start times are in integer hours (00-24), with the smallest shift time first. The first shift of all blocks of the same work center must have the same start time. Also, be sure that all cards pertaining to the same work center occur together.

TABLE 6-10. MISSION POST PROCESSOR SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	*
IN=nn	RFS data in BCD is on unit nn.	**
DATA=nn	Output unit for Chronological Sortie History.	6
STAT=nn	Output unit for Mission Success Statistics.	6
STRT=nnn	Integer start day for production of sortie history and accumulation of success statistics.	0
STOP=nnn	Integer stop day.	1000
LVL1=nn	Number of days between the basic (Level 1) Mission Success Statistics Reports.	**
LVL2=nn	Number of basic Level 1 reports between Mission Success Statistics Summary (Level 2) Reports.	**
DTIM=nnnn	Use this option to change the beginning of the time period used to calculate Daylight Sorties on the Level 2 and 3 Summary Reports.	0600
NTIM=nnnn	Use this option to reset the ending time of the time period used to calculate Daylight Sorties on the Level 2 and 3 Summary Reports.	1800
ASWT=n	When the activity switch is set to 1, no report is made against activities.	0
NERR=nn	Records are matched (FRAG and MISSIONS or FRAG and CANCELS) during processing. Depending on RFS tapout, START and STOP times, attempting this match will result in bad or incomplete records. If more bad records or incomplete records than specified occur, run terminates with diagnostics.	10
NMSN=nn	This item is used to determine the size of the data arrays for the post processors. Missions are distinguished by name, scheduled takeoff time of day, and size. If insufficient missions are allowed, run terminates with an appropriate diagnostic message. This number should be greater than the number of Form 20 data records input. Where the MAX=99 option on Form 20 was used, this quantity should be increased by approximately the number of aircraft authorized. Memory required to process this post processor with the default of 50 is 20K decimal. Increase memory allocation by 1K for each additional value of 25.	50
DBUG=n	When the debug switch is set to 1, messages for programmer analysis will be produced.	0

NOTES: *Up to two cards can be used to hold the Mission SPEC options. The first card must be the only card that starts with the word SPEC and the last card must end with a blank followed by an asterisk(*). Therefore, when only one SPEC card is used, it must also end with the blank followed by an asterisk.

**There is no default for these entries. If not specified, the run will stop with an appropriate diagnostic message.

TABLE 6-11. SUPPORT EQUPMENT POST PROCESSOR SPEC CARD

OPTION	DESCRIPTION	DEFAULT
SPEC	Required as first entry.	-
IN=nn	Support Equipment data in BCD is on unit nn.	1
NUM=nnn	Number of pieces of support equipment to be graphed.	*
STRT=nnn	Integer starting day for production of graphs.	0
STOP=nnn	Integer stopping day for production of graphs.	60
DBUG=n	Additional output is produced depending on the value of n as follows: 0 - error messages only 1 - above plus input data printed for desired graphs 2-3 - above plus message indicating any resource ID's on file but not desired 4 - above plus task start and stop intervals, model and actual counts (programmer aids)	0

NOTE: *One or more cards must follow SPEC card to indicate which support equipment resources are to be graphed. The user inputs the resource ID's in a free form format followed by an asterisk(*). The number of entries must not exceed the number in the NUM option or the run is terminated.

VII. CHANGE CARD SPECIFICATIONS

A. CHANGE CARD PROCEDURE. (See Table 9-42 for sample CHANGE CARD file)

Once the Input Module produces an initialization file for the Main Module to process, the user may find it necessary to make certain run specifications or make certain small variable changes prior to the simulation run. It is possible, depending on the variable, to make these changes or specifications during the Main Module processing and consequently avoid additional input processing. CHANGE CARDS have been defined to permit this action. The CHANGE CARDS are included as a part of the run deck on the CHANGE file designated on the Main Module SPEC card (see SPEC card write-up).

Only one of these cards, the "STOP" card, is always mandatory to start the simulation and indicates the total time the user desires to simulate. This "STOP" card will always be the last CHANGE CARD in any set of CHANGE CARDS. Each variable CHANGE CARD should be used only once since the last CHANGE CARD parameters read override all previous ones of that particular type. The exception to this would be the SWICH and Special Request cards which permit requesting multiple reports to be printed at various simulation times.

B. SWICH SETTING.

An important variable in the list of variables that can be changed is one called "SWICH." Each of these switches has a specific function to perform in the Main Module. Only switches 4 and 5 are set equal to 1 automatically by the input module. All others are off at the start of the run. Normally, the switches are bimodal where "0" is off and "1" is on. Where additional values are allowable, they are described in Table 7-1.

The variable SWICH is the only one of the change variables which requires that two pieces of information be combined to insert on the change card in Columns 7-12 (IPAR). Both the SWICH number and desired setting are combined. The SWICH NO. is right justified only to Column 11 and the setting is placed in Column 12.

Examples are:

Set SWICH 15 on - IPAR = 151
Set SWICH 6 to 4 - IPAR = 64
Set SWICH 5 off - IPAR = 50

No limit is made as to how often a particular SWICH is set or the time when it is set. This is entirely up to the user. An example would be where a user wishes to output the RFS data from the end day 6 through day 10. SWICH #9 would be turned on at day 6 and off at day 10. This would require two SWICH CHANGE CARDS. When a BOSTAT change card is used, SWICH #8 is automatically set. It should never be set by the user since it is only needed in the collection of data for selected reports.

C. NON USE CHANGE CARDS

The Forecast and Decision model implemented in LCOM I has not yet been implemented in LCOM II. However, their driving parameters and change cards are in the model for possible future implementation. The applicable change cards described within the tables, that should not be used are as follows:

ALFA	BATCH	CVALU	ESS	FLTR	SMCON	TINCR	TRIG
ALPHA	BOTM	DSTAT	FLOOR	SCALE	TFCST	TRACK	

D. CHANGE CARD FORMAT AND PARAMETER REQUIREMENTS

The CHANGE CARDS must be written in the prescribed format (see Table 7-2) with no additional comments added. The parameters that are required for each change card are specified in Table 7-3. The function of each change card and cautions to be adhered to are described in Table 7-4.

Edits are conducted on many of the parameter fields and result in either warning or fatal messages. In most cases the abort condition caused by the fatal message is deferred until Change Cards are read.

TABLE 7-1 SWICHes UNDER USER CONTROL

SWICH No.	Description (See footnote 1)
1	See footnote 2.
2	See footnote 2.
3	See footnote 2.
4	Controls Performance Summary Report Level I output. See footnote 3.
5	Controls Performance Summary Report Level II output. See footnote 3.
6	See footnote 2.
7	Unused.
8	Controls the backorder status report. See footnote 4 and BOSTAT Change Card.
9	Produces the realized flying schedule data on file designated by user on SPEC card.
10	Controls the use of the cannibalization routine. If set = 2, Programmer Diag. will print a lot.
11	Provides the user with a complete listing of all input task's means variance, highest possible draws and lowest possible draws. Also indicates the initial conditions (draws) for each failure clock. This is done when the switch is on.
12	Controls the outputting of the Manpower Matrix data. Value = 1 - produces ON and OFF aircraft backorder matrix data on file designated by user of SPEC card. Value = 2 - produces ON and OFF aircraft in-process matrix data on file selected by user on SPEC card. Value = 3 - produces both ON and OFF in-process and backorder aircraft matrix data on file selected by user on SPEC card.
13	Controls all detailed programmer diagnostic messages and is automatically turned on and off for a trace of a specific aircraft when the FPAR field of a change card variable DSPLAY is set to some small value or a specific aircraft NET ID. See footnote 5.
14	Controls the printing of detailed programmer diagnostics. See footnote 5. Value = 1 - causes printing of entries and exists from main routines Value = 2 - prints above plus internal routine diagnostics and KTIMSW diagnostics.

Value = 3 prints all above plus additional reconfiguration QSTAT reports and failure set operation.

15 Controls the printing of detailed programmer diagnostics for the KTIMSW implementation.

NOTES:

1. CONTROL Parameters - Value = 0 = off; Value = 1 = On; Value greater than 1 = still on but has special meaning.
   - Switches 13-15 are normally only used by a programmer to trace problems.
2. Not Implemented - SWICH 1, 2, 3 and 6. (Forecast and Decision module)
3. Automatically set - SWICH 4 and 5 by the Input Module, if Form 10 entered properly.
4. Automatically set - SWICH 8 should never be set on or off by the user.
5. Operational -Only on the NON-PRODUCTION Version of LCOM II.

TABLE 7-2 CHANGE CARD FORMAT

Columns	Name	Description	Remarks
1-6	VNAM	Variable Change Name	Left justified
7-12	IPAR	Integer Parameter	Right justified
13-25	FPAR	Floating Parameter	Decimal point in Column 19
26-31	IAPAR	Alpha Parameter	Left justified
32-37	IPAR2	2nd Integer Parameter	Right justified
38-50	FPAR2	2nd Floating Parameter	Decimal point in Column 44

TABLE 7-3 CHANGE CARD PARAMETER REQUIREMENTS

VNAM	IPAR	FPAR	IAPAR	IPAR2	FPAR2	NOTE 12
AABORT	Percent of Air Aborts	Decrease Percent	Mission Name	Control Table Index	Configuration	TIME=0
ABTENT	Control Table Index	N/A	Aircraft Name	N/A	N/A	TIME≥0
ABTPCT	Decrease Percent	N/A	Aircraft Name	N/A	N/A	TIME≥0
ALFA	N/A	Value	N/A	N/A	N/A	NON USE
ALPHA	Forecast Parameter (1-2)	Value	N/A	N/A	N/A	NON USE
ALTCOL	Desired Report Column	N/A	Activity Name	N/A	N/A	TIME=0
APROB	Control Table Index	N/A	N/A	Probability (0-100000) See Note 11	N/A	TIME≥0
ATTPCT	Decrease Percent	N/A	Aircraft Name	N/A	N/A	TIME≥0
AUTH	Resource ID Number	Quantity	N/A	N/A	N/A	TIME≥0
AUTHA	Resource Type (1-4)	Multiplier	N/A	N/A	N/A	TIME≥0
BATCH	N/A	$ Amount	N/A	N/A	N/A	NON USE
BOSTAT	N/A	Request Time (Days)	N/A	N/A	N/A	TIME=0
BOTM	N/A	Value	N/A	N/A	N/A	NON USE
CANCM	N/A	N/A	Aircraft Name	N/A	N/A	TIME=0
CANNIB	Max number to cannibalize	N/A	Aircraft Name	Max holes	N/A	TIME≥0
CATOP	Priority Category	Value	N/A	N/A	N/A	TIME=0
CKCNG	Clock ID No.	New Mean (Decimal or Days)	N/A	See Notes 1,2,3	N/A	TIME=0

CKDEC	Position of Clock Decrementing in the CTP.NOCL Table	New Decrement Value (Decimal or Days)	N/A	Decrement No. for this task	N/A	TIME≥0
CMULT	Value (1,2, or 3) See Notes 3,5	Multiplier	N/A	Percent See Note 4	N/A	TIME≥0
CONSUM	Configuration Number	N/A	Aircraft Name	N/A	N/A	TIME≥0
CVALU	Forecast Parameter (1-3)	Value	N/A	N/A	N/A	NON USE
DELT	Priority Category (1-3)	Value (Days)	N/A	N/A	N/A	TIME≥0
DSPLAY	Aircraft Number (Option for Display Post Processor)	Aircraft Number See Note 5, Table 7-1	N/A	N/A	N/A	TIME≥0
DSTAT	System Statistic	N/A	N/A	N/A	N/A	NON USE
EPROB	Control Table Index	N/A	See Note 9	Probability (0-100000) See Note 11	N/A	TIME≥0
ESS	N/A	Value	N/A	N/A	N/A	NON USE
EXPED	N/A	Value	N/A	N/A	N/A	TIME≥0
FACTOR	N/A	Value	N/A	N/A	N/A	TIME=0
FCFTSK	Task ID	N/A	N/A	N/A	N/A	TIME=0
FLOOR	N/A	Value	N/A	N/A	N/A	NON USE
FLTR	N/A	Value	N/A	N/A	N/A	NON USE
GENRAT	Configuration No.	N/A	Aircraft Name	N/A	N/A	TIME=0
GPROB	Control Table Index	N/A	N/A	Probability (0-99999) See Note 11	N/A	TIME≥0
GRAPH	N/A	N/A	N/A	N/A	N/A	TIME=0
HITMAT	N/A	Turn On Time (Days)	N/A	N/A	Turn Off Time (Days)	TIME≥0

VNAM	IPAR	FPAR	IAPAR	IPAR2	FPAR2	NOTE 12
HITOFF	N/A	Absolute Time (Days)	N/A	N/A	N/A	TIME≥0
HITON	N/A	Absolute Time (Days)	N/A	N/A	N/A	TIME≥0
IPSTAT	N/A	Request Time (Days)	N/A	N/A	N/A	TIME≥0
ISEED	Random Seed ID	Value (odd)	N/A	N/A	N/A	TIME≥0
ITEM	N/A	Request Time (Days)	N/A	N/A	N/A	TIME≥0
KTIMSW	N/A	Reset Interval (Hrs)	Aircraft Name	N/A	N/A	TIME≥0
LCNT	Value	N/A	N/A	N/A	N/A	TIME≥0
MAXFLY	Maximum no. of aircraft expected	N/A	Aircraft Name	N/A	N/A	TIME≥0
MNSTAT	N/A	Request Time (Days)	N/A	N/A	N/A	TIME≥0
MTXBAL	N/A	Start Request Time (Days)	N/A	N/A	Stop Request Time (Days)	TIME=0
NOPOMO	N/A	N/A	N/A	N/A	N/A	TIME=0
NPRE	Priority Category (1-3)	Value (No. Jobs)	N/A	N/A	N/A	TIME≥0
OTALL	Priority Category (1-3)	Value (Hrs)	N/A	N/A	N/A	TIME≥0
PARTSP	N/A	Request Time (Days)	N/A	N/A	N/A	TIME=0
PCT	N/A	Value	N/A	N/A	N/A	TIME≥0
PRBABT	Abort Percent (integer between 1-100)	N/A	Mission Name	N/A	N/A	TIME=0
PRBATT	Attrition Percent (integer between 1-100)	N/A	Mission Name	N/A	N/A	TIME≥0

PRBRAM	RAM Percent (integer between 1-100)	N/A	Mission Name	N/A	N/A	TIME≥0
PREPM	Variable No.	Value (Hrs)	N/A	N/A	N/A	INVALID
PSROUT	(See description for additional data requirements)	Request Time (Days)	N/A	N/A	N/A	TIME≥0
PWAIT	Priority Category (1-3)	Value (Hrs)	N/A	N/A	N/A	TIME≥0
QSTAT	N/A	Request Time (Days)	N/A	N/A	N/A	TIME≥0
RAMTME	N/A	Mean Time (Days)	Aircraft Name	N/A	Std Dev (See Note 6)	TIME≥0
RCYC	Frequency (No. of Level I PSRs)	N/A	N/A	N/A	N/A	TIME≥0
RECRD	No. of Dumps	Interval (Days)	N/A	Tape No.	N/A	TIME≥0
RFREQ	N/A	Frequency (Days)	N/A	N/A	N/A	TIME≥0
RPCOL	Resources ID No.	New Column No.	N/A	N/A	N/A	TIME=0
RUN	N/A	N/A	Name	N/A	N/A	TIME≥0
SAUTH	Resources ID No.	Shift No.	N/A	New Amount	N/A	TIME≥0
SCALE	N/A	Value	N/A	N/A	N/A	NON USE
SECIN	Time of Next SECIN Processing (in Integer Days)	N/A	N/A	N/A	N/A	TIME≥0
SMCON	N/A	Value	N/A	N/A	N/A	NON USE
STOP	N/A	No. of Days See Note 8	N/A	N/A	N/A	TIME≥0
STORAC	Class/Configuration #	N/A	Aircraft Name	N/A	N/A	TIME=0
SUPONF	N/A	Turn On Time (Days)	N/A	N/A	Turn Off Time (Days)	TIME=0

VNAM	IPAR	FPAR	IAPAR	IPAR2	FPAR2	NOTE 12
SWICH	Switch Setting (Ref VII-B)	Change Time (Days)	N/A	N/A	N/A	TIME=0
TACMOD	N/A	N/A	N/A	N/A	N/A	TIME=0
TFCST	N/A	Time (Days)	N/A	N/A	N/A	NON USE
TINCR	N/A	Time (Days)	N/A	N/A	N/A	NON USE
TKCNG	Task ID No.	NEW Mean	N/A	See Notes 1,2,3	N/A	TIME≥0
TMULT	Key (1-5)	Multiplier	N/A	See Notes 3,4,5	N/A	TIME≥0
TRACK	N/A	Value	N/A	N/A	N/A	NON USE
TRAKAC	Sequence No. or Tail-Number of aircraft	Turn On Time (Days)	Aircraft Type	N/A	Turn Off Time (Days)	TIME≥0
TRIG	Forecast Parameter (1-3)	Value	N/A	N/A	N/A	NON USE
TSUB	Task ID of Task to be Replaced	Replacement Time (in decimal hrs less than 24.0)	N/A	Task ID of Substitute Task	SWITCH back time (in decimal hrs less than 24.0 (See Note 7)	TIME=0
TSUB1	Task ID of Task to be Replaced	Replacement Time (in decimal days)	N/A	Task ID of Substitute Task	SWITCH back time (in decimal days) (See Note 10)	TIME≥0
UCOST	Resource ID No.	New Cost	N/A	N/A	N/A	TIME=0
WARMUP	No. of days in Warmup Period	N/A	N/A	N/A	N/A	TIME=0
WCXCOL	Desired Report Column	N/A	Activity Name	N/A	N/A	TIME=0

NOTES:

1. Percent of new mean for new variance, i.e., 50 - 50% of FPAR is the variance.

2. If task or clock distribution type is triangular, FPAR is the most likely value, IPAR2's first 3 digits is the % FPAR for the new Optimistic Value, and last 3 digits is the % FPAR for the new Pessimistic Value, i.e., 50150 means 50% of FPAR = Optimist ic, 150% of FPAR = Pessimistic.

3. Empirical distributions cannot be changed.

4. The IPAR2 field, which is the percent of multiplier, is used on the variance distribution. IPAR2 = 50 means 50% of FPAR is used as variance multiplier.

5. Not applicable for triangular distributions. All parameters (opt, most likely, pes) will be multiplied by FPAR.

6. An additional parameter, standard deviation of Lognormal RAM repair time must be provided in cols 38-50. If missing, card will be ignored (FPAR2 field). Zero not permitted.

7. An additional parameter, time of switch back to original task ID, is provided in the FPAR2 field. If not entered the default is end of day (24th hour).

8. Not applicable on a set of SECIN scheduled Change Cards. However, STOP card itself must be used. On a RESTART set of Change Cards, value will override original STOP card value.

9. IAPAR = '*' for first branch from an E node; blank for other branches.

10. An additional parameter, time of switch back to original task ID, is provided in the FPAR2 field. If not entered there is no switch back.

11. The assumed decimal point in probabilities (APROB, EPROB, GPROB) is between the 5th and 6th digits from the right (i.e., 90000 = .9 and 300 = .003). Leading zeros are unnecessary.

12. This column indicates the allowable simulation time the Change Card can be used.

TABLE 7-4 CHANGE CARD VARIABLE DESCRIPTION

Name	Description
AABORT	Specifies the percentage of air aborts (IPAR) by mission name (IAPAR). The next network branch to process (IPAR2), returning configuration of the aircraft (FPAR2), and the decrease percentage of sortie length (FPAR) may also be specified but are optional. If the next network branch and returning configuration are not specified then the normal post sortie network entry branch and post sortie configuration are used. If the FPAR field is left blank then there will be no decrease in the sortie length.
ABTENT	Alters next node after a sortie when air abort or sympathetic air abort occurs. This change card is valid for Version 2.0 but invalid for Version 3.0. See AABORT for Version 3.0 implementation.
ABTPCT	The input of an air abort sortie length (by aircraft) is actually a decrease percentage where, for example, a value of 50 would indicate the scheduled sortie length is to be decreased by 50%. This change card is valid for Version 2.0 but invalid for Version 3.0. See AABORT for Version 3.0 implementation.
ALFA	Smoothing constant for mean absolute deviation; used in forecasting system statistics.
ALPHA	Smoothing constant for forecasting system statistics: 1 = Normal, 2 = Accelerated.
ALTCOL	Used to input alert replenishment report column. (Activities are defined on Form 17). Must be used with TACMOD card.
APROB	Used to alter the probability of the A selection node on the network branch (Control Table Index) specified in IPAR. The probability specified in IPAR2 must be integer and between 0 and 100.
ATTPCT	Used to input the percentage the sortie length will be reduced for a particular aircraft when attrition occurs.
AUTH	Current amount authorized for a specific resource (not on a shift). May be used at time greater than zero to increase non-aircraft resources only.
AUTHA	Multiplies the authorization of all types IPAR Resources by value in FPAR. Types are; 1 = aircraft, 2 = parts, 3 = men, 4 = AGE, and 6 = other. Aircraft quantities cannot be increased at TIME greater than 0.0; all others can.
BATCH	Amount (in dollars) by which levels are increased by Decision Model. Total authorized accross all items for each time period of Decision Model operation.
BOSTAT	Request a Back Order Status Report at time FPAR.

BOTM Cutoff for Decision Model; if UTIL for an item is above BOTM, the item will not be considered for raising of level.

CANCM Request the total abandonment of all missions on the EXOG tape associated with the aircraft whose name appears in the IAPAR field. Aircraft name must be exactly as that on the Form 20s.

CANNIB The maximum number of parts permitted to be cannibalized for (donated to) a single aircraft of type specified in IAPAR field is defined in the IPAR field, default is 2. The IPAR2 field is used to define the maximum number of holes a cannibalization action can cause on the type of aircraft specified. Default is 5.

CATOP A list of values assigned to the top of each priority category. (3 categories are used)

CKCNG Request changing the mean of clock (IPAR) to new value (FPAR) and its variance to new value (IPAR2*FPAR*.01).

CKDEC Changes clock decrement. Requires programmer assistance.

CMULT Requests multiplying mean and variance of all clocks of type (IPAR) by factor (FPAR), where IPAR = 1 for all nonconstant clocks, IPAR = 2 for all constant clocks, and IPAR =3 or blank for all clocks. This change card is only valid if IPAR = 1. The implementation of CMULT with IPAR = 2 and 3 will be completed in the future.

CONSUM Specifies the aircraft configuration to consume. Without this card, configuration 1 will be used.

CVALU Observed value of system statistic in last period. See DSTAT.

DELT Specifies the amount of time by priority group, that a job within that group must stay in backorder prior to having its job priority escalated.

DSPLAY Requests a post-processor display of the Aircraft specified in the IPAR field, also requests a display of transaction diagnostics for the Aircraft specified in the FPAR field (only on the non-production version).

DSTAT Identification of the system statistic controlling operation of the Decision Model.

1 = Mission Effectiveness, 2 = Aircraft Turnaround, 3 = Average No. of Sorties per Aircraft per Day.

EPROB Used to alter the probability of the E selection mode on the network branch (Control Table Index) in IPAR. The probability specified in IPAR2 must be integer and between 0 and 100000. When used the first E mode branch of the series to be changed, must be specified before any other branch. This first branch can be found in the INDEX field of the Node Usage Report and it is denoted on the change card by IAPAR = '*'. The other branches need to be specified only if they are going to be changed.

Name	Description
ESS	Scaling factor in the Decision Model; control relative worth of items.
EXPED	Defines the multiplier for the remaining task duration time when the task is expedited.
FACTOR	Changes the value at which the quantity columns on Form 12 are considered to represent a percentage of time the quantity of one is used. The value is entered on the FPAR field of the change card.
FCFTSK	Defines the FCF task. Task ID is obtained from the Input Module task dictionary.
FLOOR	Minimum value for an observed statistic. (Forecast Model)
FLTR	Number of standard deviations above the mean at which a statistic is translated; used to partially reject unusual data.
GENRAT	Specifies the aircraft configuration to generate on a task. Without this card configuration 1 will be used.
GPROB	Used to alter the probability of the G selection mode on the network branch (Control Table Index) specified in IPAR. The probability specified in IPAR2 must be integer and between 0 and 99999.
GRAPH	Triggers outputting of Graph Post-processor output data. No parameters necessary; starts at time = 0.
HITMAT	Specifies the time to turn on data collection for Hit Matrix and the time to turn off data collection. Multiple non-overlapping HITMAX cards can be used where each one prints the matrix and zeroes the data storage arrays.
HITOFF	Turns off data collection for Hit Matrix, prints the matrix and zeroes the data storage arrays. Requires a companion HITON entry. This change card is valid for Version 2.0 but invalid for Version 3.0. See HITMAT for Version 3.0 implementation.
HITON	Turns on data collection for Hit Matrix. See HITOFF. This change card is valid for Version 2.0 but invalid for Version 3.0. See HITMAT for Version 3.0 implementation.
IPSTAT	Requests an Inprocess Status Report at time FPAR.
ISEED	Changes the value of the random seeds used in the model. Eight seeds are set up, but only six are used: #1 is unused; #2 for task duration selection; #3 for failure clock operation; #4 for FACTORfeature operation; #5 for task duration test with SWICH 11 on - also used for air aborts, attrition, and RAM repair; #6 for task selection on A, E, and G parameters; #7 for random multiplier for initial clock settings; #8 is unused.

ITEM	Requests a Resource Status Report at time FPAR.
KTIMSW	Used to input the reset interval (FPAR) for the K selection mode time switch by specific aircraft (IAPAR). Max = 240 hrs.
LCNT	A variable used to improve the efficiency of the task starting procedure while optimizing the likelihood of starting a backordered task without trying them all. All tasks backordered for a resource being released from a completing task are reviewed (by priority) to build a list of candidate tasks to attempt to start. The length of the list of candidates is LCNT plus the quantity released. LCNT is defaulted to 5. Increasing this value could considerable increase run time.
MAXFLY	The maximum number of each type of aircraft that are in the simulation at any given point in time. Required if internal configuration is specified in the Input Module. This change card is valid for Version 2.0 but invalid for Version 3.0.
MNSTAT	Requests a Mission Status Report at time FPAR.
MTXBAL	Request outputting of on-hand balance records for the matrix postprocessor beginning at time FPAR and ending at time FPAR2. Must be used in conjunction with Switch 12. (see table 7-1). This change card is valid for Version 2.0 but invalid for Version 3.0.
NOPOMO	Causes the main simulation to be conducted without Form 12A resource substitution, i.e., does not consider either the Form 12A general or task specific resource substitutions. This change card does not affect general substitution of the prime resources specified on Form 12. However, it will also not activate general (Form 13 defined) substitution, i.e., X's are required on Form 12's.
NPRE	The allowable number of jobs that a task can preempt according to its priority category.
OTALL	Overtime allowance. The amount of time allowed for normal completion of a task by each priority category.
PARTSP	Requests outputting of parts post processor data beginning at time FPAR. (No turn off time - end of run).
PCT	The factor by which the remaining task time is increased when interrupted.
PRBABT	Used to input an air abort percentage by mission type. This change card is valid for Version 2.0 and invalid for Version 3.0. See AABORT for Version 3.0 implementation.
PRBATT	Set attrition percentage for mission, i.e., the percent of aircraft which will be removed by attrition of all aircraft which fly and do not air abort.
PRBRAM	Defines the RAM repair percentage by mission type. Requires a RAM repair time change card RAMTME.

Name	Description
PSROUT	Used to define a Performance Summary Report (PSR) partitioning to occur after time FPAR. NOTE: This change card must be followed by a request card or cards which specifies the PSR stat groups or individual PSR STATS to be printed. Groups are specified as G1, G2, ... G6, and STATS are specified as 1, 2, 3, ... 70. An asterisk, *, follows the last entry preceeded by a blank field. Multiple request cards can be used as long as the asterisk is on the last card. Multiple PSROUT/Request card sets may be input.
PWAIT	Allowable wait time (by priority category) for normal task completion. Preceeds invoking preemption.
QSTAT	Requests an aircraft class Queuing Status Report at a specified time.
RAMTME	Defines RAM repair time. Like PRBRAM, only valid at time 0.0. Run will abort if this card not entered as a paired set with a PRBRAM change card. Also FPAR2 field must be greater than zero.
RCYC	The frequency of Level I reports at which Level II reports are produced (in multiples of RFREQ).
RECRD	Causes a specified no. of memory dumps (IPAR) at some particular interval of time (FPAR) onto a particular logical unit (IPAR2). Change card invalid unless DUMP spec option used.
RFREQ	The frequency at which Level I reports are produced in simulated days.
RPCOL	Requests changing the report column of a specific resource.
RUN	Run number or name.
SAUTH	Requests changing the authorization quantity of a specified resource on a specified shift.
SCALE	Scaling factor in the Decision Model. Controlsrelative worth of additional units of an item whose level is increased.
SECIN	Schedules the inputting of another set of change cards at the time specified.
SMCON	Smoothing constant for item utilization statistic.
STOP	Preselects the number of days to be simulated. It must always be used, and be the last card in a change card deck. However, the time value is effective only on the original set of change cards or restart change cards. SECIN scheduled sets of change cards do not use this value.
STORAC	Specifies the class/configuration # (IPAR) into which all initially generated aircraft of the type specified (IAPAR) are placed (only the originals). Default is the first class specified on Form 17. Card only valid at time = 0. For those generated by task see change card GENRAT.

SUPONF Requests the support equipment post processor tapout begin at time FPAR and continue until time FPAR2.

SWICH Permits changing most control switches. See table 7-1.

TACMOD Requests the TACMOD enhancements. Can only be input at time 0.0 and can only be input once. Affects only TAC options concerned with weather, alerts and mission tapering.

TFCST The time the forecast model is to be turned on.

TINCR Time interval between successive forecasts.

TKCNG Requests changing the mean of task (IPAR) to new value (FPAR) (in decimal days) and its variance to new value (IPAR2*FPAR*0.01).

TMULT Requests multiplying the mean and variance of all tasks of type (IPAR) by Factor (FPAR), where IPAR; Key = 2-5 per footnote on Form 12, and Key = 1 or blank for all tasks. Sortie tasks cannot be changed.

TRACK Used by the forecasting model to switch from one kind of time series model to another.

TRAKAC Requests outputting of display post processor data for asingle aircraft of a specified tail-number or sequence number and aircraft type, beginning at time FPAR and ending at time FPAR2. The sequence number is specified in the Aircraft Identity Dictionary.

TRIG A value, which when attained by the system statistic identified by DSTAT, causes the decision model to operate.

TSUB Defines the task ID of a task to be replaced, the task ID of the task which will be substituted, and the time the substitution is to occur. FPAR2 indicates the time when the tasks which were replaced are to be reset to their original task ID. This takes place on a daily basis and will continue throughout the entire simulation.

TSUB1 Defines the task ID of a task to be replaced, the task ID of the task which will be substituted, the day the substitution is to occur, and the day the original task will be switched back. If the switch back day is not specified then no switch back will occur. Only one substitution and switch back can occur per TSUB1 card. Only tasks of the same type may be substituted for each other, and neither a sortie task nor the dummy task can be used.

UCOST current unit cost of a specified resource.

WARMUP Specified length of model warmup period. The first level II report is produced at end of warmup period. Only valid at time = 0.0.

WCXCOL Used to input weather cancel report column. Can only be used in conjunction with TACMOD card.

VIII. INPUT FORMS AND THEIR PREPARATION

In describing the input forms, Form 11 is described first because of its fundamental inportance in the data package. Once it is understood many of the other related forms are more easily understood. The remaining order of form descriptions is also not in numerical sequence for similar reasons of data clarity and interrelationship. The required input sequence and other procedures are discussed in Chapter XI.

NOTE: In preparing the input data, all data records from the same input form are grouped and must be preceded by a header record. This record contains the form number in Columns 2 and 3 with the remainder of the card left blank or optionally filled in with any information the user desires.

Where possible, prepared forms used as figures in this chapter will be similar to those of the sample problem in Chapter IX. However, most of these examples will be different than the sample problem.

For the purposes of clarity and ease of reference to the individual forms, the remainder of this chapter will be typed across the page in the opposite direction. Where possible, the form will be described in the text on the page immediately facing the referenced form.

A. Form 11 - Task Network

Before filling out Form 11, it is recommended that a task network diagram be drawn. This design should be complete in every respect, including all task names and selection parameters. If this is done, the process of transcribing the information onto the input form will be greatly simplified. Consider the example network and Form 11 in Figure 8-1. Each branch of the network is defined as a Form 11 with all applicable data as follows:

1. Prior Node. The node preceding the task is entered here. Where two or more branches emanate from a common node, each of the tasks has that node name as its prior node.

2. Task ID. The alphanumeric name of the task is entered here. Two nodes can be specified without having an intervening task by simply leaving the Task ID field blank. However, the selection mode and parameter fields still apply.

3. Next Node. The node following the task is entered here. Where two or more branches lead into a common node, that node is identified as the next node for each of the branches. On Figure 8-1 networks, all terminal nodes are blank. The "next node" field is then left blank, indicating that processing for that network segment is complete.

4. Selection Mode. The selection mode for the branch is entered here. Refer to Chapter IV, Section B3d for a description of each selection mode. For sequential tasks, where no selection is involved, it may be left blank and a "D" is assumed.

When a network section is called, a "C" is placed in Column 26 and the entry point node of the network section is placed in the Task ID field. The next node name meaning remains the same as before indicating the node to return to after completing the section.

The S selection mode can only be assigned to a sortie task whose starting time is controlled by the mission data. When this mode is encountered, mission data is referenced to establish the earliest possible starting time. If the preceding task is completed and other mission requirements satisfied, the task will be started.

5. Selection Parameter. Only five selection (A, E, F, G, and H) modes require parameters to be entered here. When the A, E, or G selection mode is used, enter the individual probabilities for branch selection. For the "E" selection mode, the sum of these probabilities for all branches from a single node must equal 1.00.

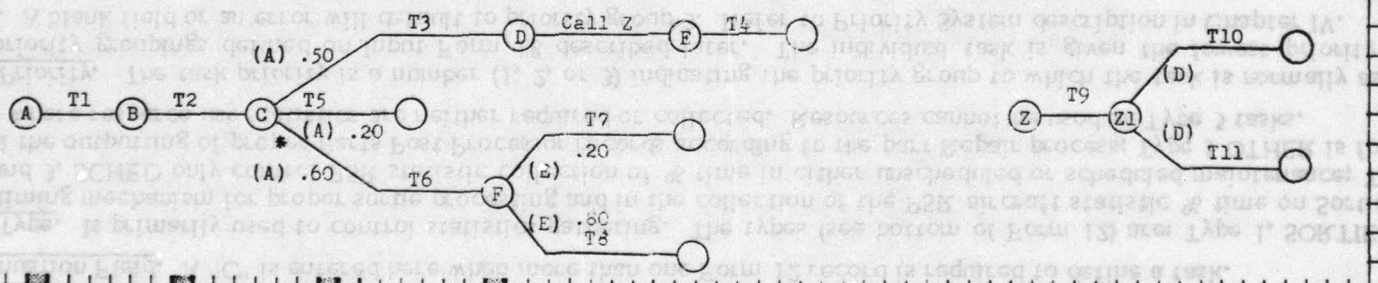
The F selection mode is used to select those tasks leading to and involving the repair of an aircraft, system, or subsystem that has had a subindenture part failure. When the F selection mode is used, the resource clock (defined on Form 13) which is associated with the failure must be entered in Columns 27-32 of the last task in the set of F tasks which lead to the failure. A "dummy" resource clock could be associated with a task, followed by other tasks with D, A, or E selection modes which actually discover the failures. In this case, the dummy resource clock would be the one defined on Form 13. All resource clocks defined in Form 13 and used in Form 11 will have to be also entered on Form 14 to be operative. Also, if the resources clocks entered in Form 14 are not entered on Form 11, an error occurs. H selection mode checks are similarly entered, but cannot be in series like the F's. Refer to Chapter IV, Section B9 and B10.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SELECT MODE	SELECTION PARAMETER	TASK DESCRIPTION
11						HEADER RECORD
	A	T1	B	D		
	B	T2	C			
	C	T3	D	A	.50	
	C	T5		A	.20	
	C	T6	F	A	.60	
	D	Z	E	C		
	E	T4				
	F	T7		E	.20	
	F	T8		E	.80	
	Z	T9	Z1			
	Z1	T10	Z2			
	Z1	T11	Z2			

In the example network, task T1 is followed by task T2. The upper branch (task T3) is then taken with probability .50, the middle branch (T5) is taken with probability .20, and the lower branch (T6) is taken with probability .60. Note that this is a non-mutually exclusive "A" selection. If T3 is done, the next step is to call the network section labeled "Z". Following completion of the network section, processing resumes with task T4. If T6 is done, the next step is a mutually exclusive "E" selection. T7 will be done 20 percent of the time, and T8 will be done 80 percent of the time. In the network section, after completion of T9, both T10 and T11 can be completed in parallel. Nodes are used to separate tasks and also serve to identify common points from which alternative branches may be taken.



SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = Do task, E = Either, F = Failure controlled, G = Get one, H = Halt, I = Ignore (cannib), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

FIGURE 8-1 FORM 11 PREPARATION EXAMPLE - TASK NETWORK

B. Form 12 - Task Definitions. Each task in the task network must be separately defined on Input Form 12. This definition includes such information as the priority and duration of the task and the resources required by and associated with it. A task needs to be defined only once, even if it is referenced more than once in the task network. The various factors are described as follows: Refer to Figure 8-2, which inputs Figure 8-1 data.

1. Task Identification. The "task name" is entered here and must be the same as the name used in the task networks.

2. Continuation Field. A "C" is entered here when more than one Form 12 record is required to define a task.

3. Task Type. Is primarily used to control statistics gathering. The types (see bottom of Form 12) are: Type 1, SORTIE assists in the mission timing mechanism for proper sortie processing and in the collection of the PSR aircraft statistic % time on Sortie; Type 2, UNSCHED and 3, SCHED only control PSR statistic collection of % time in either unscheduled or scheduled maintenance; Types 4, 6, and 7 control the outputting of proper Parts Post Processor records according to the part Repair process; Type 5 OTHER is for delay type tasks only where resource use statistics are neither required or collected. Resources cannot be used on Type 5 tasks.

4. Task Priority. The task priority is a number (1, 2, or 3) indicating the priority group to which the task is normally assigned. Refer to the priority groupings defined on Input Form 18 described later. The individual task is given the lowest priority in the assigned group. A blank field or an error will default to priority group 3. Refer to Priority System description in Chapter IV.

5. Task Duration. The task duration is defined in terms of a mean, a variance, and a distribution type as described in Chapter II, Section C6. Not all types are used in this example.

6. Associated Resource. As mentioned in Chapter IV, Section B7, portions of the task network will generally be concerned with the "production" of a generated resource. For example, following the removal and replacement of an alternator from an aircraft, bench check and repair type tasks are concerned with only a reparable alternator and would not be associated with the aircraft. The first of these tasks which occurs independently of the higher assembly (e.g., aircraft) must be so identified by placing an asterisk in Column 29 of the task definition. This indicates that this and subsequent tasks should not interfere with the processing or the release of the higher assembly (e.g., aircraft) upon completion of its network processing. The name of the resource which is to be returned to a serviceable pool at the conclusion of its series of tasks is entered in Columns 30-35. Sometimes, there may be no resource involved, in which case this field is left blank. The annotation of the first task must be similarly accomplished for all subsequent indentures that may be described in the network. Normally, to keep a stock level in balance each part consumed (See B7 below) there should be an action (task) in the network to return the part to the pool upon completion of the task and its accompanying time, e.g., base repair or NRTS. This is the responsibility of the user and accomplished by using this generate feature.

7. Required Resources. Resources required by the task are identified in the columns entitled "task resource requirements." Normally, all resources are returned to the pool of available resources following completion of the task. If the resource is to be "consumed" by the task (i.e., not returned to the available pool), a "C" is placed in the column marked "C" following the resource name. The quantity used or consumed is entered in the column following the "consume" column. Two important restrictions exist involving consumption. Men cannot be consumed and aircraft must be consumed when entered as a required resource. See Chapter IV, Section B8.

If there are more than three resource requirements, they may be entered on successive lines of the form in the appropriate columns, with Columns 5-35 left blank. An option of annotating the same task name in Columns 5-10 on these successive cards with a "C" in Column 11 indicates that this is a continuation card for that specific task. This option has special error checking capabilities and ensures that these successive records do not get out of sequence.

General resource substitution can be activated thru the use of the "C" columns (43, 52, or 61). An "X" placed in any of these fields indicates that general substitutions (as specified on Form 13) is permitted. Since these same columns are used for the consume flag, it is impossible to have both features operate simultaneously for the same resource.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

01 02	03	04	05–10	11	12	13	14	15–20	21–26	27	28	29–35	36	37–45	46–54	55–63	64	65–70
CARD I.D.	Blank or A	○	TASK I.D.	Cont "C"	Task Type ◉	Priority		TASK DURATION MEAN (OPTIM) ◒	TASK DURATION VARIANCE (LIKELY) ◒	DIST	*	ASSOCIATED RESOURCE/ RCS ◑		TASK RESOURCE REQUIREMENTS RESOURCE / C / QTY.	RESOURCE / C / QTY.	RESOURCE / C / QTY.		TRIANGULAR DISTRIBUTION (PESSIM) ◒
1 2														HEADER RECORD				
			T1		31			1H		C								
			T2		21			2H	10M	X				ASSY-1 C 1	HANGER 1			
			T3		31			3H	20M	W				MAN-B 1				
			T4		31			2H	3H	T				MAN-C 2				4H
			T5		21			5H	30M	X				MAN-D 1				
			T6		22			6H	40M	N		*ASSY-1		MAN-E 2				
			T7		22			7H		C				MAN-F 1	TESTER 1			
			T8		42			10D	2D	L								
			T9		21			6H	40M	X				MAN-G 1				
			T10		21			5H		C				MAN-E 1				
			T11		21			4H	20M	N				MAN-A 1	MAN-B 1	MAN-D 1		
			T11	C										MAN-E 1				
		A	T11									RCS-1	1	MAN-A X 2	MAN-D 1	MAN-E 1		

Form 12A - Task Specific Resource Substitution - Any task capable of being processed by an alternate set of manpower resources can be described on Form 12A. This form is to be integrated into the body of the Form 12s immediately after the Form 12 record(s) describing the task and its primary resource requirements. The following fields contain additional data:

1. Col 3 - must contain an A.
2. Task I.D. - The task name, same as preceeding Form 12 record.
3. Col 11 - Contains a "C" only on 12A continuation cards, not the first 12A in a set of 12As.
4. Associated Resource Field - Optional field - when used is interpreted as a key name for a "Resource Combination Set" (RCS) of resources defined. This RCS once defined on any Form 12A can be used to represent the same set of resources without specifically defining the entire set again.
5. Col 36 - Optional field - signifies a sequential preference of Form 12As. This can be a number from 1 to 9 to signify the order of preference of the alternate crews, if different than the order of 12A input.
6. Task Resource Requirements - Same as Form 12 records, except that only manpower resources can be used on Form 12As. Also, when an X is placed in the "C" field (Col 43, 52, or 61), it activates the generalized substitutions specified on Form 13. A "C" is not permitted in these fields on a Form 12A record.

◉ TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only), 6 = Condemned, 7 = First base repair (treated as unscheduled.)
◒ For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.
○ Applicable to Model Version 3.0.
◑ Resource Combination Set (Form 12A)

FIGURE 8-2. FORM 12 PREPARATION EXAMPLE - TASK DEFINITION

C. Form 13 - Resource Definitions

Task resource requirements were specified on Input Form 12. All of these resources must be separately defined on Form 13 - Resource Definitions. The various input factors for this form are described as follows: Refer to Figure 8-3.

1. Resource Identification. The resource name appears in this column.

2. Entry. To define non-aircraft resources that can enter the network, place an asterisk (*) in column 11. For example, if activity networks were defined into which the TESTER would enter, the TESTER would be defined as shown.

3. Resource Type. The resource type is entered in this column. The five allowable type codes are: I = Aircraft, P = Parts, M = Men, A = AGE (equipment), and C = Failure Clock.

4. Report Column. On the output reports, summary statistics for each resource will appear in the output column specified here. The various column headings are separately defined on Input Form 10, described later. Assignments here must correspond to those defined on Form 10. If this column is left blank, the model assigns the last or "other" columns to the specific resource. Errors in column number greater than maximum specified on Form 10 also default to this "other" column. This Field is actually three columns wide (13-15) although the column 13 is shaded.

5. Unit Cost. The dollar value of each resource is entered in the unit cost field. This cost should represent the per unit acquisition cost of the resource or the cost to lay-in one unit of the resource. Unit cost figures are reflected in some of the summary statistics. Other than that they are not used. If not entered, the Input Module has a set of defaults for each resource type. They are Aircraft = 1,000,000, Parts = 1,500, Personnel = 10,000, Equipment = 20,000.

6. Authorized Quantity. The authorized quantity of each resource is entered here. At the start of the simulation, the on-hand balance is set equal to this authorized quantity; due-in and due-out balances are set to zero. Any resource that will be placed on a shift does not require an entry here since quantities by shift will be entered on Form 16. Quantities not required but found will be ignored.

7. Substitute Resource - The identification of the substitute resource, if any, is entered in these columns. The name of the substitute resource must be also defined on a Form 13. Three additional substitute resource fields (beginning in Cols 50, 51, 69), can be used to specify substitutes. A normal reading (left to right) sequence is used to rank order resource substitutions. To specify more than four substitutes, continuation cards can be used. Only the resource ID is entered in Cols 5-10 along with the substitute resources in Cols 29-34, 50-55, 57-62, and 64-69. All other columns must be left blank.

8. Failure Rate Parameters. The remainder of this form applies to the failure mechanism discussed in Chapter IV, Section B9. The Failure rate is defined in terms of a mean and a variance and a distribution type as shown in Chapter III, Section C6. Two options are available here: (1) a specific resource can be described and if failure parameters are entered, a failure "clock" of the same name as the resource will be defined by the input module, and (2) a different name can be defined for the clock associated with a specific resource by placing a "C" in the "resource type" column and entering the failure parameters for this clock. The second method is more favorable since there is less confusion as to the resource and clock names when entering usage information on the Form 12s and 11s. This method would also permit the use of multiple clocks for a particular resource or conversely multiple resources represented by a single clock.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 13 - RESOURCE DEFINITIONS

CARD I.D.	RESOURCE I.D.	ENTRY	RES. TYPE	REPORT COLUMN	UNIT COST	AUTH. QTY	SUBSTITUTE RESOURCE	FAILURE RATE MEAN	FAILURE RATE VARIANCE	DIST	SUBSTITUTE RESOURCE	SUBSTITUTE RESOURCE	SUBSTITUTE RESOURCE
01 02 03	04 05 06 07 08 09 10	11	12	13 14 15	16 17 18 19 20 21 22	23 24 25 26 27	28 29 30 31 32 33 34	35 36 37 38 39 40 41	42 43 44 45 46 47	48	49 50 51 52 53 54 55	56 57 58 59 60 61 62	63 64 65 66 67 68 69
13							HEADER	RECORD					
	F-4C		I	1	1KK	12							
	ASSY-1		P	1	2ΦΦΦΦ	4							
	MAN-A		M	1	12ΦΦΦ		MAN-B						
	MAN-B		M	2	1ΦΦΦΦ								
	TESTER*		A	1	2ΦΦΦ	22							
	C-ASY1		C					5ΦΦH	2ΦHL				

◉ RESOURCE TYPE: I = Aircraft, P = Parts, M = Men, A = AGE, or Facilities, C = Clock.
◒ An * indicates resource can enter network.
○ Triangular distribution not allowed on this form.
◒ Applicable to Model Version 3.0.

FIGURE 8-3. FORM 13 PREPARATION EXAMPLE - RESOURCE DEFINITION

D. Form 14 - Failure Clock Decrements

The failure mechanism was fully described in Chapter IV, Section B9. As the result of performing certain tasks, the failure clocks of some resources may be decremented. Data required for this process are entered on Form 14. These data elements are described as follows: Refer to Figure 8-4.

1. Task Identification. The name of the task establishing the clock decrements is entered in the task identification field. This will be the specific task used to decrement the failure clocks time each time the task is performed. Usually this would be the sortie task or a task parallel to the sortie task although it could be any task. Tasks cannot be listed twice.

2. Resource Identification. All failure clocks which are to be decremented by the task (Columns 5-10) are listed on successive lines in this field. These clock names will have been entered on Form 13 (see Section C of this chapter).

3. Mode and Decrement. The amount by which each clock is decremented depends on the particular mode of decrementing. Three different modes are available as follows:

Mode (Col. 12)	Mode Description
S	Each of the successively listed resource clocks is decremented by the duration of the task (usually a sortie task representing operating time). No entry is needed in Columns 21-26.
C	Each clock is decremented by a constant, which appears in Columns 21-26. Only one value need be entered on the first card which contains the mode "C". Subsequent values will be ignored.
Blank	The amount of the decrement is different for each resource clock and appears in Columns 21-26 opposite each clock.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 14 - FAILURE CLOCK DECREMENTS

CARD I.D.	TASK I.D.	MODE	RESOURCE I.D.	DECREMENT
14				HEADER RECORD
	SORTIE S		CLOCKA	
			CLOCKB	
	TASK B	C	CLOCKC	20.0
			CLOCKD	
	TASK C		CLOCKE	10.5
			CLOCKF	5.9

MODE: S = Task length, C = Constant

FIGURE 8-4. FORM 14 PREPARATION EXAMPLE - FAILURE CLOCK DECREMENTS

E. Form 15 - Distributions

This form is used to input empirical probability distributions. These distributions can be used on Form 11, 12, 13, or 20. The kinds of data entered on Form 15 are described as follows: Refer to Figure 8-7.

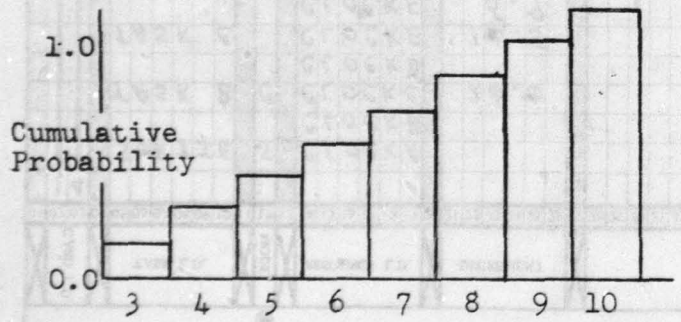
1. Distribution Identification. Each distribution is identified by a number from 1 to 999, entered here. When using this distribution, its number will be entered in the Mean field of the appropriate form preceded by an asterisk (*).

(a) Step Functions (discrete). A discrete distribution or step function is identified by placing an "S" in Column 9. A typical step function is pictured in Figure 8-5. In the case of the step function, the probabilities may be read in as either cumulative or individual probabilities. If individual probabilities are used, they are accumulated in the order of their appearance on the input form. Cumulative probabilities must appear on the form in ascending order. The last cumulative probability must equal 1.0. Individual probabilities should sum to 1.0 or the final value of the accumulated individual probabilities will be automatically set to 1.0.

(b) Linear Interpolation (Continuous). When a continuous distribution is desired, place an "I" in column 9. Linear interpolation is used in retrieving values which fall between those values supplied by the user. The distribution is input as a series of points from the continuous cumulative probability curve, such as that pictured in Figure 8-6. Note that only cumulative probabilities may be input. Furthermore, the first cumulative probability must equal 0.0, and that of the last must equal 1.0.

3. Format. Normally, all values are read in true form. In other words, if the distribution represents some time duration, or the time of day, the values are assumed to be in days and fractions of days. If the values are in hours, an "H" must be placed in Column 11. If the values are in minutes, an "M" is entered.

4. Distribution Multiplier. The column "MULT" provides the feature that once a distribution is entered and used, to reinput a similar distribution on successive runs with only larger or smaller values, the "MULT" will modify (multiply) each value by the same amount. (Note: Where distributions are to be used only in the Input Module for the Form 20s, they can be prevented from being passed to the Main Module by placing an asterisk (*) in column 68. Otherwise, they will be passed and require storage during Main Module runs.



IGURE 8-5. EXAMPLE OF AN EMPIRICAL DISTRIBUTION STEP FUNCTION

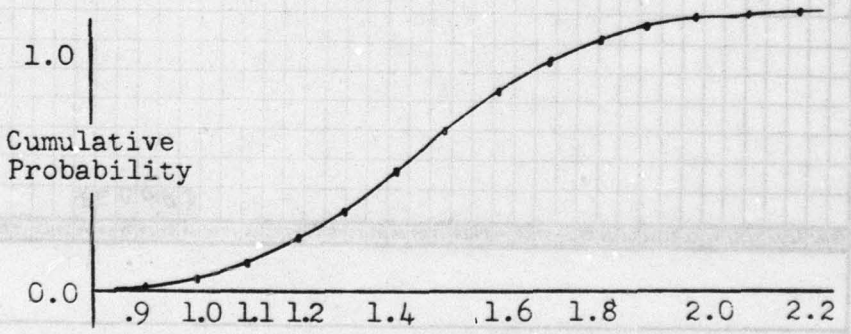


FIGURE 8-6. EXAMPLE OF AN EMPIRICAL DISTRIBUTION LINEAR INTERPOLATION

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 15 - DISTRIBUTIONS

CARD I.D.	DISTN I.D.	TYPE	FORMAT	1 PROB	1 VALUE	2 PROB	2 VALUE	3 PROB	3 VALUE	4 PROB	4 VALUE	5 PROB	5 VALUE	MULT
15						HEADER		RECORD						
	1	I	H	Φ.Φ	.9	.Φ5	1.Φ	.1Φ	1.1	.15	1.2	.25	1.3	
				.35	1.4	.5Φ	1.5	.65	1.6	.75	1.7	.85	1.8	
				.9Φ	1.9	.95	2.Φ	1.ΦΦ	2.3					
	2	S		.Φ5	3	.1	4	.1	5	.2	6	.2	7	
				.2	8	.1	9	.Φ5	1Φ					
	3	I	H	Φ.ΦΦ	Φ.Φ	.2Φ	6.Φ	.8Φ	18.Φ	1.Φ	24.0			1.5

TYPE: I = Interpolate
S = Step Function

FIGURE 8-7. FORM 15 PREPARATION EXAMPLE - DISTRIBUTIONS

F. Form 16 - Shift Change Policies

1. Single Line Shift Policy Entry. A shift policy is defined in terms of shift durations, shift repetitions, and shift authorizations. A separate line on Form 16 is used to describe each of these factors. Data entered, for each type of line, is as follows: Refer to Figure 8-8. The Shift M echanism is described in Chapter IV, Section B11.

(a) Shift Duration Line. A new shift policy begins a line by placing an asterisk (*) in column 5. On the same record up to 14 different shifts may then be defined within that policy. The duration of each shift must be placed on the same line under the appropriate column heading. If it is desired to have the shift policy take effect at some time other than time zero, this value must be entered on the same line in the field labeled "Resource ID." This value must be in terms of a discrete time value to be measured from midnight. For example, to start a shift at 8:00 A.M., insert 8H not 0800. The corresponding values in the first column will be representative of the shift starting at 0800 on the first day of simulation.

(b) Shift Repetition Line. When a sequence of shifts is to be repeated several times, the shift duration line is followed by a line with an "R" in Column 5. The number of times the sequence is to be repeated is placed under the last shift in the sequence. This repetition factor then applies to all preceding shifts,back to the point where another repetition factor applies, if any. The repetition line is optional and may be omitted entirely where a continuous cycle is defined.

(c) Shift Authorization Line. The remaining lines under each shift policy establish the resource authorizations for each shift. The resource name appears in the resource identification field, and the authorizations under the shift column headings. If no authorizations are entered, the value is assumed to be zero.

2. Extended Shift Input Entry. The input Form 16 contains a method for extending the maximum number of shifts that can be defined, to any quantity. As described above, only 14 columns of shift were available. Nine additional continuation cards for each of the *, R, and Resource authorization cards can now be defined in column 6. The maximum number of shifts obviously will be 140 (14 columns times 10 (9 continuous cards plus the original)). Only the changes necessary to extend the number of shifts to greater than 14 are specified below.

(a) Shift Durations (* card). On the first "*" card of a shift pattern, column 6 can either be left blank or contain a zero (0). This card must be first for a particular shift pattern but the order of all remaining "*" cards is flexible. On the first continuous card, a one (1) is placed in col. 6. This causes the shifts numbered 1 through 14 to be interpreted as 15-28, the two (2) interprets these shifts as 29-42, etc., for up to 9 continuation cards. NOTE: The time of start of the first shift is the same as described in 1a.

(b) Shift Repetition Cards. Same as above card - Column 6 of the card associated with the first "*" card must be left blank or contain a zero (0); 2nd one contains a 1, third one a 2, etc. Order of cards is insignificant.

(c) Shift Authorization Cards. Resource name must appear on all continuation cards. A particular resource's continuation card need not be sequential, but all cards of that resource must be together. Column 6 numbering is the same as above.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 16 - SHIFT CHANGE POLICIES

CARD I.D.	CODE	REP NO.	RESOURCE I.D.	SHIFT DURATIONS/AUTHORIZATIONS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	
16							HEADER			RECORD								
	*			8	8	8												FIRST
	R					7												
			SHOPA	4	4	4												
			SHOPB	4	2	2												
	*			8	8	8	24											SECOND
	R					5	2											
			SHOPC	3	3	2	2											
			SHOPD	4	4	Φ	Φ											
			SHOPE	2	2	2	2											
	*			8	8	8	8	8	8	8	8	8	24	8	8	8	8	THIRD
	R					5			2			5	2			5		
	*	1		8	8	8	8	8	12	12								
	R	1			2			5		2								
			CREW	1	2	3	4	5	6	1	2	3	Φ	1	2	3	4	
		1	CREW	5	6	1	2	3	2	2								
	*			8	8	8	8	8	8	8	8	8	24	8	8	8	8	FOURTH
	R					5			2			5	2			5		
			CREW	1	2	3	4	5	6	1	2	3	Φ	1	2	3	4	
	*	1		8	8	8	8	8	12	12								
	R	1			2			5		2								
		1	CREW	5	6	1	2	3	2	2								

Examples. Referring to the examples in Figure 8-?, under the first policy, there are three 8-hour shifts per day. The sequence is repeated 7 times, thus making up an entire week. Shop A has 4 men assigned to each shift. Shop B has 4 men assigned to the first shift and 2 men assigned to the second and third shifts. The second policy has three 8-hour shifts per day during the week and one 24-hour shift on Saturday and Sunday. The third policy defines a twenty-eight day period and used the extended form capability. Here each weekday shift is manned the same but on the four individual weekends the shift manning is different. On the first and third weekends, all shifts are based on 8 hour periods, no one on the second weekend, and on the last weekend 12 hour shifts are in evidence. The fourth policy is simply a reshuffling of the records of the preceeding policy, and may be easier to read, but, will not process. It is included only for descriptive purposes. All the *, R, and resource records must be together as in the third policy.

FIGURE 8-8. FORM 16 PREPARATION EXAMPLE - SHIFT CHANGE POLICY

CODE: * = New Policy, R = Repeat

Repetition number - zero or blank thru 9.

G. Form 10 - Performance Summary Report

This form is used to control the frequency of the Performance Summary Report (PSR) and also its appearance, in terms of columnar headings for the data, as described in Chapter IV, Section B17. This is the primary form used to specify the format of the PSR report. The data elements to be entered are as follows: Refer to Figure 8-9.

1. Report Frequency. This number, in simulated hours, determines the frequency with which the Level I reports are produced. It is entered in Columns 7-10.

2. Report Cycle (Record Subtype 01). This number entered in Columns 13-14 specifies the number of Level I reporting periods over which the Level II report will summarize. If no entry is made here no Level II report will be produced without first setting SWICH 5 on (=1) with a change card.

3. Column Headings. This data, which may be alphanumeric, is provided by the user to label column headings on the Performance Summary Report. Separate labels may be consistent with the report sections to which resource items or mission types are assigned. Headings for columnar breakout for the various report sections are specified by the record subtypes as follows:

Form 10 Section	Report Section Heading	Record Subtype (Col 4-5)
Operations	Operations	03
Aircraft	Aircraft	05
Maintenance	Personnel	07
Supply	Both Shop Repair and Supply	09
Equipment	Equipment	11
Run Name	Run Number	13

Up to ten non-blank columns can be named as a single record. When more than ten columns are desired, additional records of the same subtype may be used until all columns are specified. The input module counts those specified and then adds one additional column to the output. Erroneously assigned column headings or those left blank default to this additional column titled "OTHER" on the PSR report.

A run name can be printed in the upper left hand corner of the performance summary report. This can be six characters in length and is input as a record subtype 13 with the name beginning in Column 7.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 10 - PERFORMANCE SUMMARY REPORT

02 03: 1 0 — REPORT SPECIFICATIONS — HEADER RECORD

04 05: 0 1 — THE REPORTING CYCLE TIME IS 07 08 09 10: 1D. EVERY 13 14: 7 CYCLES, A SUMMARY REPORT IS PRODUCED.

04 05: 0 3 — IN THE OPERATIONS AREA, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
CLSUPTINTERD	RECON								

04 05: 0 5 — FOR AIRCRAFT, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
F-4C									

04 05: 0 7 — IN THE MAINTENANCE AREA, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
CREWCHOMPERSFLTENGHYDTECCOMTEC									

04 05: 0 9 — FOR SUPPLY STATISTICS, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
ASSY-1	PART-X								

04 05: 1 1 — FOR EQUIPMENT ITEMS, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
TRUCK									

04 05: 1 3 — THE RUN NAME FOR THIS INITIALIZATION IS:

1
RUNAME

FIGURE 8-9. FORM 10 PREPARATION EXAMPLE - PERFORMANCE SUMMARY REPORT

H. Form 18 - Priority Specification

This form is used to control the actions which depend on the priority scheme within the model. Refer to Figure 8-10. The form is in a questionnaire format designed to be self-explanatory. Notice that "defaults" are provided all of the factors and will be automatically used if the user fails to provide his own values. The terms in parenthesis are the change card names that may be used to redefine the parameters during the simulation run.

1. Categories. These are ranges of priorities which are defined as the default priorities described in Chapter IV, Section B15.

2. Preemption. If a task cannot start because of a lack of men or equipment, it may be desirable to take the needed resources from some other tasks. The entries in record subtype 4 serve to implement this policy. If zeroed out, the preemption will not be permitted.

The PCT data on record subtype 9 defines the impact of this decision on the task duration. If it is set to 1.0, it also effectively negates the impact on the task duration of the preempted task. It does not, however, prevent preemption.

3. Expedite. It may be better to wait until other tasks are finished rather than preempt any. These fields define how long it is permissible to wait before attempting to preempt other tasks. IF tasks are expedited to obtain resources, record subtype 8 defines the impact of this decision on the remaining task duration. With the EXPED factor set to 1.0, it effectively eliminates expediting of task durations.

4. Overtime. Overtime is considered for use whenever a shift change occurs that lowers authorizations and the authorizations to be dropped cannot be obtained from the onhand balance. First, the shift mechanism checks to see if jobs in process could finish within the overtime allowance for their category. If there still are more authorizations needed, the shift mechanism checks to see if expediting jobs would allow them to finish within the overtime allownace. Otherwise, it preempts jobs to get the rest of the needed authorizations.

5. Backordering. If a task is backordered, it is waiting to be processed because of a lack of resources. It is assumed that according to its initial importance, or priority, the task priority will increase while it is backordered. The amount of the increase is controlled by the entries in record subtype 7. The smaller the number, the faster the priority increase. A very large figure will tend to nullify this policy. If task priorities are increased from time to time, all tasks will eventually be completed.

02 03 **18** PRIORITY SPECIFICATIONS

THERE ARE A NUMBER OF PRIORITY LEVELS USED, WHICH RUN FROM ZERO (MOST URGENT) TO THE VALUE GIVEN IN STATEMENT 3 BELOW. THESE PRIORITIES ARE FURTHER BROKEN INTO THREE SEPARATE CATEGORIES FOR WHICH DIFFERENT POLICIES APPLY.

NOTES: 1. IN ALL CASES, IF NO FIGURE IS PLACED IN THE BLANK BOXES, THE SIMULATION WILL USE THE FIGURE IN THE DOTTED BOX.

2. TERMS IN PARENTHESIS ARE THE NAMES OF THE APPLICABLE MAIN MODEL CHANGE CARDS.

04 05 **01** CATEGORY 1 RUNS FROM ZERO TO [07 08] (10).

04 05 **02** CATEGORY 2 RUNS FROM CATEGORY 1 TO [07 08] (20).

04 05 **03** CATEGORY 3 RUNS FROM CATEGORY 2 TO [07 08] (30), WHICH IS ALSO THE MAXIMUM NUMBER OF LEVELS.

THE NEXT FOUR STATEMENTS REFER TO THE POLICIES WHICH APPLY TO EACH CATEGORY.

	CATEGORY: ①	②	③	
04 05 **04**	07 **2** (3)	13 **Φ** (2)	19 **Φ** (1)	TASKS IN EACH CATEGORY CAN PRE-EMPT UP TO TASKS OF LOWER PRIORITY TO OBTAIN RESOURCES. (NPRE)
04 05 **05**	07 08 09 **.25**	13 14 15 **Φ.50**	19 20 21 **Φ.75**	TASKS IN EACH CATEGORY CAN WAIT HOURS FOR AN EXPEDITED TASK TO RELEASE RESOURCES. (PWAIT)
04 05 **06**	**.75**	**.50**	**.25**	TASKS IN EACH CATEGORY CAN UTILIZE HOURS OF OVERTIME FOR NORMAL TASK COMPLETION. (OTALL)
04 05 **07**	**20**	**48**	**48**	TASKS IN EACH CATEGORY WHICH HAVE BEEN BACKORDERED HOURS WILL HAVE THEIR PRIORITY INCREASED. (DELT) (TASK MADE MORE URGENT).

04 05 **08** ANY TASK MAY BE EXPEDITED BY SHORTENING THE REMAINING PROCESSING TIME TO [07 08 09] **.95** (1.0) OF ITS VALUE. (EXPED)

04 05 **09** IF A TASK IS INTERRUPTED BY PRE-EMPTION, ITS REMAINING PROCESSING TIME IS INCREASED BY A FACTOR OF [07 08 09] **1.1** (1.0). (PCT)

FIGURE 8-10. FORM 18 PRIORITY SPECIFICATION

I. Form 20 - Sortie Generator - Refer to Figure 8-11.

1. Control Records. The sortie generator expects to read two records prior to the regular form 20 records: (1) the normal header record, and (2) a control record specifying the amount of flying and activity schedule to generate. The various data elements on this control record are thus interpreted:

(a) Columns 1-4. If a listing of the exogenous data generated is desired, insert the word "LIST" in columns 1 through 4 otherwise leave blank. When the TACMOD feature is used there must be a T in column 2, i.e., "LTST".

(b) Day - Columns 5-7, Insert the total number of days of exogenous data to generate. This and the Key Word (below) are fields that must be complete on this card to produce an exogenous tape.

(c) Columns 9-14. Insert a Key Word designating the identity of this exogenous data. Any six character identifier (alphanumeric) will do and must be present.

(d) Columns 16-73. Exog Description. This field may contain any or no information as desired. This information as well as the key word is printed at the beginning of each simulation run. This helps identify runs that used several exogenous files against a single data initialization.

2. Mission and Activity Data. The remainder of the Form 20s contain all the mission and activity requirements. The Form 20s can be run separately from all other forms to permit the sortie generator to produce the exogenous events tape for the duration of the simulation. However, if empirical distributions are used, Form 15 must be processed with the Form 20s. A given mission may be flown or activity processed at certain scheduled times of the day, or on a random basis throughout the day. A given pattern may in turn be scheduled daily, or in daily intervals, and may go into effect or be terminated on any given day during the period of operation. The various data elements entered on all Form 20s (refer to the example in Figure 8-11) are described as follows:

(a) Day. The day within which the mission or activity is to occur is entered here. All requirements must be in ascending order by day, i.e., 1, 2, 5, etc. The mission or activity is then scheduled to occur within the day specified, e.g., for day 1, it will be between time = 0.0 and time = 1.0.

(b) Number of Missions or Activities. This field contains the number of missions to be flown or activities to be processed during the day. If the requirement is for a single mission or activity only, the field may be left blank. The number of missions or activities may also be input as an empirical distribution by entering the distribution number preceded by an asterisk. The sortie generator would then make a random draw from this distribution.

(c) Take-off or Activity Time. The take-off time is represented as a 4-digit time of day. For example, 8:30 AM is written as 0830 and 2:30 PM as 1430. If the use of an empirical distribution of take-off times is desired, enter the distribution number preceded by an asterisk. If explicit mission take-off or activity times are to be read on subsequent cards, an "R" must be placed in the take-off time field in column 15. This time is considered as the actual scheduled start time for activities and they are requested/fragged on the Exogenous file at this time. For missions and sorties, the frag time equals the scheduled take-off time minus the lead time.

(d) Aircraft ID or Resource ID. The resource name of the aircraft associated with the mission or activity, or the non-aircraft resource associated with the activities placed here. This must correspond exactly to the resource name on Form 13. Where non-aircraft resources are specified, Form 13's column 11 must contain an asterisk. A blank field will cause the dummy (non-aircraft) resource to be used. The dummy resource is automatically defined and is the last one in the resource dictionary.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 20 - SORTIE GENERATION DATA

01	02 03	04	05 06 07	08	09 10 11 12	13 14	15 16 17 18	19	20 21 22 23 24 25	26	27 28 29 30 31 32	33	34 35	36 37	38 39	40	41 42 43 44 45 46	47 48 49 50 51 52	53	54	55 56 57 58	59	60 61 62 63	64	65 66	67	68 69 70 71 72 73	74	75 76 77 78 79 80
	CARD I.D.		DAY		NUMBER OF MISSIONS OR ACTIVITIES		TAKEOFF OR ACTIVITY TIME		AIRCRAFT I. D. OR RESOURCE I. D.		MISSION I. D. OR ACTIVITY I. D.		MISSION SIZE MIN	MAX	SPARE		MISSION LENGTH MEAN (OPTIM) ◒	VARIANCE (LIKELY) ◒	DIST		LEAD TIME ○		CANCEL TIME ○		PRIORITY		CYCLE INT	STOP		TRIANGULAR DISTRIBUTION (PESSIM) ◒	
	20										HEADER		RE	CO	RD														
	IS		60		KEYW				SAMPLE		ENTRY		ON	FI	RST		RECORD												
			1		1		Φ8ΦΦ		F-4C		INTRD		2	2	1		1.5	.5	N		1.Φ		30M		1		1999		
			1		*2		*3		F-4C		CLSPT		2	2	1		*1				Φ		+15		5		1999		
			5		7		R		F-4C		TNG		1	1	Φ		1+ΦΦ		C		.5		.5		10		1 10		
							Φ7ΦΦ																						
							Φ9ΦΦ																						
							1ΦΦΦ																						
							11ΦΦ																						
							14ΦΦ																						
							16ΦΦ																						
							18ΦΦ																						
			7		1		Φ4ΦΦ		F-4C		TEST			1Φ	Φ														
	W																												

◒ For triangular distribution use - input optimistic (optim), most likely (likely), and pessimistic (pessim) in columns indicated. Cannot be used with TACMOD feature or card sequence numbers.
◉ Max field is the only size field applicable to activities.
○ Must be zero or blank for activities.

FIGURE 8-11. FORM 20 PREPARATION EXAMPLE - SORTIE GENERATION DATA

(e) Mission ID or Activity ID. The name of the mission. This must correspond exactly to the mission or activity name on Form 17.

(f) Mission Size. During the simulation, the maximum number of aircraft will be flown if possible. IF the number of available aircraft is less than the minimum, the entire mission will be scrubbed. SPARE represents the number of additional aircraft that are prepared for flight, and are held in a reserve status. Only the max field is applicable to activities; the number entered will cause that number of independent activities to be attempted. Max = 99 has a special meaning; it requests that all on-hand (Available and Cocked) aircraft of the type specified be started into the network at frag or activity time.

(g) Mission Length. The mission length entered here applies only to sorties. The mean, variance, and distribution type are specified, or an empirical distribution may be referenced by placing an asterisk and a distribution number in the "MEAN" field. NOT applicable to activities, but must be zero (0).

(h) Mission Lead Time. The lead time represents the maximum time required prior to takeoff in order to accomplish pre-sortie tasks. The takeoff time less the lead time is the time at which the simulation is notified of the existence of the mission (i.e., read from the exogenous tape). If the actual pre-sortie tasks extend beyond the scheduled takeoff time, the mission will be delayed, or perhaps cancelled. Not applicable to activities.

(i) Mission (or Activity) Cancellation Time. Cancellation policy is expressed in terms of a cancel time. If the mission is delayed beyond the takeoff time by an amount greater than the cancel time, the mission is cancelled. No provisions are made to reschedule the mission. For activities, if the individual activity has not started by Activity Time plus Cancel Time that activity will be cancelled. No provisions are made to reschedule the activity. If the cancel time is not specified for the activity then the activity will not be cancelled.

(j) Priority. A priority relating to the specific mission activity may be entered here, the lower numbers having the highest priority. If none is entered, the model will default to one. When using the default priority scheme, these values should normally be less than 9 to ensure pre-sortie tasks have higher priorities than Form 12 defined tasks.

(k) Scheduling Cycle. It is possible to reschedule missions and activities at some daily interval specified by INT. This pattern is repeated until the day specified by STOP is reached. If these columns are blank, the missions are scheduled only for the day designated in Columns 5-7.

3. Example. On the sample input form (figure 8-12), an interdiction mission (INTRD) has been scheduled for the first day at 8:00. Two aircraft must be flown by 8:30 or the mission will be cancelled. A spare aircraft is prepared as back-up. The length of the mission is taken from a normal distribution with a mean of 1.5 hours and a variance of .5 hours. This mission will be rescheduled every day for the next 999 days.

A close support mission (CLSPT) will also be fragged each day for the next 999 days (actually 60 since only 60 days are generated). The number of such missions for each day is determined by a draw from distribution #2, the take-off time for each mission obtained from distribution #3, and the mission length is obtained from distribution #1. There is no advance warning for this mission; the aircraft have 15 minutes to get off the ground. Next, seven training missions (TNG) are to be flown each day at the scheduled times, starting on day 5 and continuing until day 10. Finally, on day 7 a TEST activity is to be processed at 0400 for 10 aircraft.

J. Form 17 - Mission Entry Points

Both Missions and Activities are defined on the Form 17, but they are described separately below. They are both processed within a single group of Form 17s and require the normal Header Record. Mission and Activity names are mentioned on Input Form 20 -Sortie Generation Data (refer to Chapter VIII, Section J of this chapter). On Form 17 - Mission Entry Points, each mission name is unique and is associated with a particular entry node in the task network. This entry node identifies the first in a sequence of tasks which must be accomplished to satisfy the mission or activity requirement. The data element entries are as follows: See Figure 8-12.

1. Inputting Missions.

(a) Mission ID. The mission name is entered here. It will be unique to the particular aircraft type listed in Columns 43-48.

(b) Report Column. On the Main Module's Performance Summary Report, summary statistics for each mission type will appear in the output column specified here. This must conform with the user defined columns on Form 10. Errors and blanks default to the last (extra) column.

(c) Network Entry Point Node. Enter the name of the node in the task network entry point for the activity.

(d) Pre-Sortie External Configuration. This name specifies the aircraft external configuration required. All aircraft selected will be in this external configuration or be reconfigured to it per user directed reconfiguration information on Form 21. If reconfiguration is specified, it will take place prior to processing the network entry point. See Caution on Figure 8-12.

(e) Post-Sortie External Configuration. This name specifies the external configuration into which the aircraft on this mission will be placed, upon completion of the sortie, e.g., the mission external configuration above might be ORDL (ordinance loaded) and the post-sortie external configuration, ORDR (ordinance released). See Caution on Figure 8-12.

(f) Aircraft Assignment Search Pattern. (optional) Enter the name of the specific search pattern which describes the sequence of aircraft external configuration to search in order to obtain an aircraft for this mission. The search pattern must be described on Form 21. Search Pattern names must be unique by aircraft, i.e., one aircraft type specified in Col. 43-48 cannot use a search pattern of another aircraft type. In addition, blanks default to an internally generated pattern with the same name as the aircraft specified in Columns 43-48. This Search Pattern will search all aircraft external configurations in the order they were defined above or in the order prescribed on Form 21, if redefined.

(g) Aircraft Name. (required) The name of the specific aircraft resource that will be processing this mission must be entered here. If none is entered, the Input Module will process the data, provide all the edits, but will not produce an initialization.

2. Inputting Activities.

(a) Mission ID. The Activity name is entered here.

(b) Report Column. Activities as a new LCOM II feature have been defined but no data is collected on the main Performance Summary Report (PSR). Therefore, this Report column has been deactivated. In the interim, this column is used to define the type of resource the activity applies to. For aircraft, insert the two characters "AC" in these columns. This will cause the input model to read and edit the remaining data from Columns 22-48. For non-aircraft, enter the two characters "OT." This causes data in Columns 22-48 to be ignored.

(c) Network Entry Point Node. Enter the name of the node in the task network entry point for the activity. This entry point must not reach a sortie task.

(d) Pre-Sortie External Configuration. (optional) This field is valid only with "AC" in Columns 12-13. This name specifies the aircraft external configuration required. All aircraft selected will be in this external configurati on or be reconfigured to it prior to entering the network per user directed reconfiguration information on Form 21. See Caution on Figure 8-12.

(e) Post-Sortie External Configuration. (optional) This field is valid only with "AC" in Columns 12-13. This name specifies the external configuration into which the aircraft will be placed, upon completion of the activity network. See Caution on Figure 8-12.

(f) Search Pattern. (optional) Valid only with "AC" in Columns 12-13. Enter the name of the specific search pattern which describes the sequence of A/C external configuration to search in order to obtain an aircraft for this activity. The search pattern rules described for missions also apply here.

(g) Aircraft Name. (required) Valid only with "AC" in Columns 12-13. The name of the specific aircraft resource that will be processing this activity must be entered here. If none is entered, the Input Module will process the data, provide the edits, but will not produce an initialization.

3. External Configurations Release Rules (Of prime importance when constructing the Form 21s.)

TYPE OF PROCESSING	CONCERNING	RELEASED AT	IN CONFIGURATION SPECIFIED AS	IN STATUS
Mission (Flown)	Aircraft Flown	End of Post-Sortie Network	Post-Sortie on Form 17[b,c]	Available
Mission (Flown)	Spare Aircraft Not Flown	Sortie Task	Pre-Sortie on Form 17[b]	Cocked
Mission (Cancelled)	Late Aircraft	Sortie Task	Pre-Sortie on Form 17[b]	Cocked
Aircraft Activity	Processing Completion	End of Network	Post-Sortie on Form 17[d]	Available[f]
Aircraft Generation	Simulation Startup or at Generate Task	Time of Generation	First Configuration Specified on Form 17[e]	Available

a. External Configurations do not apply to non-aircraft resources.

b. When both Pre and Post-Sortie fields are blank, the configuration will be as found by the search pattern; status will remain as specified in the last column.

c. Configuration can be changed with the AABORT Change Card; status will still be "Available."

d. When both Pre and Post-Sortie (Activity) fields are blank both the configuration and status will remain the same as found by the search pattern.

e. Can be modified with the STORAC Change Card (simulation startup) or with the GENRAT change card (generate task). However, be sure some search patterns described on the Form 21s search the "Available" status of either the first configuration specified on Form 17 or on either the STORAC Change Card or the GENRAT Change Card.

f. Except for Alert Replenishment and Alert Release activities which will release aircraft as cocked.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 17 - MISSION/ACTIVITY ENTRY POINTS

CARD I.D.	MISSION I. D. OR ACTIVITY I. D.	REPORT COLUMN	NETWORK ENTRY POINT NODE	PRE-SORTIE EXTERNAL CONFIGURATION	POST-SORTIE EXTERNAL CONFIGURATION	AIRCRAFT ASSIGNMENT SEARCH PATTERN	AIRCRAFT NAME	
17								HEADER RECORD
	PREFLT	AC	A			ATTRIT	F-4C	
	CLSPT	1	B	CONWUP	CONWUP	NORMAL	F-4C	
	INTRD	2	B	CONWUP	CONWUP	SP3	F-4C	
	RECON	3	C	NUCWUP	NUCWDN	SPECAL	F-4C	
	FERRY	4	D				F 4C	
77								

CAUTION:

a. Review the external configuration release rules, para j.3 before completing Form 21s.

b. Each new entry of a different external configuration defines a configuration.

c. There must be at least one external configuration specified in the set of Form 17s.

d. Different missions may use the same external configuration names on different aircraft.

e. The following indicates the validity of various Form 17 External Configuration extries.

PRE-SORTIE EXTERNAL CONFIGURATION	POST-SORTIE EXTERNAL CONFIGURATION	VALIDITY CHECK
Configuration Name	Configuration Name	Valid Entries.
Configuration Name	Blank	Pre-Sortie Configuration used for Post-Sortie Configuration.
Blank	Configuration Name	Invalid Entries, will be Fatal Error.
Blank	Blank	Valid Entries. However, the search pattern must not specify any external reconfiguration.

FIGURE 8-12. FORM 17 PREPARATION EXAMPLE - MISSION ENTRY POINTS

K. Form 21. Aircraft Assignment Search Patterns.

On this form, the user defines particular sequences of aircraft configurations to search to obtain aircraft mission and activity assignments and provides the means of reconfiguring aircraft when necessary. The entries are as follows: See Figure 8-13.

1. Aircraft Assignment Search Pattern. The Search Pattern Name from the Form 17 is entered here. A default pattern for each aircraft type (having the same name as the aircraft) is predefined, but may be modified by specifying it in this field and redefining its search sequence. If not modified, it searches by default the aircraft classes in the order they were defined on the form 17s. If the default pattern is modified, it must contain all the classes entered on the Form 17s.

2. Cont "C". A "C" is entered here on any continuation card required if the search pattern being defined contains more than two (2) aircraft configurations. The continuation card must follow the first card containing the pattern name and may include the pattern name or be blank. With the name inserted, out of sequence cards will be detected.

3. * -STATUS- If a search is to be made for a "cocked" aircraft of the specified configuration, then a "C" is entered here. If instead an "available" aircraft is to be searched for, then an "A" is entered here. See para J3 above to determine appropriate entries. Statuses not specified will not be searched.

4. External Configuration Data.

(a) Configuration Name. The specific external configuration to be searched is entered here. It is recommended that the search pattern for a particular mission searches the Pre-Sortie External Configuration first. This eliminates a lot of undesirable reconfiguration being accomplished. It is also recommended that all the external configurations in the scenario be searched at least once. This eliminates pocketing aircraft in an external configuration which is not searched and causing aircraft non-availability.

(b) Reconfiguration Entry Node. If an aircraft is selected in the specified external configuration, it may need to be reconfigured to the Pre-Sortie External Configuration specified on Form 17. If so a network section should be performed to reconfigure the aircraft. The entry node to this network section is entered here and must have been defined on Form 11. If an external reconfiguration entry node is specified on this form with an external configuration, the reconfiguration will be performed. If no reconfiguration is desired, then leave this field blank.

5. Internal Configuration Data.

(a) Equipment Group. The name which identifies a unique group of internal equipment is entered here. A search is performed for an aircraft which is configured with the specified external configuration and group of internal equipment. Each group specified on this form must be defined on Form 23.

(b) Reconfiguration Entry Node. When an aircraft is selected with the specified group of internal equipment, it may need to be reconfigured so that the required internal equipment is in the aircraft before take-off. If internal reconfiguration is necessary, the entry node to the reconfiguration network section is entered. If no internal reconfiguration is desired, leave this field blank.

6. Cut-Off Time (hours). The total time to prepare an A/C of the specified external and internal configuration for a mission is entered here. It should be at least as great as the average time to process the pre-sortie tasks plus any reconfiguration networks.

7. SP.SKIP. Skip if spare fields - columns 42 and 73. See note in Figure 8-13.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 21 - AIRCRAFT ASSIGNMENT SEARCH PATTERNS

CARD I.D.	AIRCRAFT ASSIGNMENT SEARCH PATTERN	CONT "C"	*	EXTERNAL CONFIGURATION NAME	EXTERNAL RECONFIGURATION ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIGURATION ENTRY NODE	CUT-OFF TIME (HOURS)	SP. SKIP	*	EXTERNAL CONFIGURATION NAME	EXTERNAL RECONFIGURATION ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIGURATION ENTRY NODE	CUT-OFF TIME (HOURS)	SP. SKIP
01 02 03	04 05 06 07 08 09 10	11	12	13 14 15 16 17 18	19 20 21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41	42	43	44 45 46 47 48 49	50 51 52 53 54 55	56 57 58 59 60 61	62 63 64 65 66 67	68 69 70 71 72	73
21				HEADER RECORD												
	ATTRIT		C	UNCONF				Ø.Ø			AUNCONF				Ø.5	
	NORMAL		C	CONWUP				Ø.Ø			ACONWUP				Ø.9	
			C	BMS5ØØ	ER1			1.1			ABMS5ØØ	ER1			1.8	
			C	RACKS	ER2			2.4								
	SP3		C	CONWUP		GROUP1		Ø.Ø			CCONWUP		GROUP2	IR1	1.2	
			A	CONWUP		GROUP1		Ø.6			ACONWUP		GROUP2	IR1	1.8	
			A	CLEAN	ER3	GROUP1		1.Ø			ACLEAN	ER3	GROUP2	IR1	1.7	
			C	CLEAN	ER3	GROUP1		1.9			CCLEAN	ER3	GROUP2	IR1	2.9	
	SPECAL		C	NUCWUP		GROUP3		Ø.Ø			CNUCWUP		GROUP4	IR2	1.Ø	
			A	NUCWUP		GROUP3		Ø.8			ANUCWUP		GROUP4	IR2	2.Ø	
	F-4C		C	CLEAN		GROUP4	IR2	1.Ø			CUNCONF		GROUP4	IR2	1.Ø	
			C	RACKS		GROUP4	IR2	1.Ø			CCONWUP		GROUP4	IR2	1.Ø	
			C	BMS5ØØ		GROUP4	IR2	1.8			CNUCWUP		GROUP4	IR2	1.Ø	
			C	NUCWDN		GROUP4	IR2	1.Ø			ACLEAN		GROUP4	IR2	2.Ø	
			A	UNCONF		GROUP4	IR2	2.Ø			ARACKS		GROUP4	IR2	2.Ø	
			A	CONWUP		GROUP4	IR2	2.Ø			ABMS5ØØ		GROUP4	IR2	2.Ø	
			A	NUCWUP		GROUP4	IR2	2.Ø			ANUCWDN		GROUP4	IR2	2.Ø	

Note. Fields 42 and 73 may contain an "X" to eliminate a configuration from being searched when satisfying spare requirements. In this figure col 42 contains an "X" and the aircraft in the external and internal configuration specified in col 12 thru 41 are not considered when satisfying spare aircraft requirements when using the SPECAL search pattern. A spare search pattern is effectively a subset of the specified search pattern.

* "C" for cocked aircraft or "A" for available aircraft

FIGURE 8-13. FORM 21 PREPARATION EXAMPLE - SEARCH PATTERNS

L. Form 22 - Internal Equipment Authorizations/Changes

This form specifies all the trigger nodes required to perform the necessary internal reconfiguration for each type of aircraft. The form entries are as follows: See Figure 8-14.

1. Aircraft Name. The name of the specific aircraft resource that will be processing a mission specified on Form 17. The mission's search pattern defined on Form 21 must consider internal reconfiguration in order for the aircraft to be used on this form.

2. Cont "C". A "C" is entered here on any continuation card required if there are more than 3 Trigger Nodes associated with an aircraft. The continuation card must follow the first card containing the aircraft name and may include the aircraft name or be blank.

3. Internal Equipment Data.

(a) Trigger Node. The name of the node which will either add or subtract a quantity of one of the specified internal equipment from the internal configuration of the aircraft processing. This node must also be specified on Form 11. More than one trigger node can be defined for a particular piece of internal equipment.

(b) Equipment Name. The name of the internal equipment which is to be added or subtracted from the aircraft processing is entered here. This equipment must also be specified in at least one internal equipment group on Form 23.

(c) * Trigger Status. The action to be performed on the specified internal equipment is entered here. If a quantity of one of the equipment is to be added to the internal configuration of the aircraft, then a "+" is entered. If a quantity of one is to be subtracted, then a "-" is entered.

(d) Authorized Quantity. The initial authorized quantity of the specified internal equipment on the aircraft is entered here. This quantity is set at the start of simulation. Also, this quantity must be entered only the first time the equipment is specified on this form for the particular aircraft type.

M. Form 23 - Internal Equipment Group Definitions.

This form defines all the groups or combinations of internal equipment which are needed to perform internal reconfiguration. Only the combinations of equipment which need to be considered on Form 21 should be specified. The sequence of searches within a search pattern is important when determining the number of different equipment groups needed. See Figure 8-15.

1. Internal Equipment Group. The name which identifies a unique group of internal equipment and quantities is entered here. The name must correspond to the desired equipment group specified on Form 21.

2. Cont "C". A "C" is entered here for continuation cards required when the equipment group contains more than five different internal equipment. The continuation cards must follow the first card containing the group name.

3. Internal Data.

(a) Equipment Name. The name of the internal equipment which is required to be operative on an aircraft is entered here. Only the internal equipment which will be deferred for some missions need be considered. The equipment specified on this form must correspond to the equipment defined on Form 22.

(b) Quantity. The quantity of the internal equipment which is required to be operative on an aircraft is entered here.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 22 - INTERNAL EQUIPMENT AUTHORIZATIONS/CHANGES

CARD LD.	AIRCRAFT NAME	CONT "C"	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY
01 02 03	04 05 06 07 08 09 10	11	12 13 14 15 16 17	18 19 20 21 22 23	24	25 26 27 28 29 30	31 32 33 34 35 36 37	38 39 40 41 42 43	44	45 46 47 48 49 50	51 52 53 54 55 56 57	58 59 60 61 62 63	64	65 66 67 68 69 70
22			HEADER RECORD											
	F-4C		ADDGUN	GUN	+	1	ADDCAM	CAMERA	+	4	SUBGUN	GUN	-	
	F-4C		SUBCAM	CAMERA	-									

Trigger Status (+ or -)

FIGURE 8-14. FORM 22 PREPARATION EXAMPLE - INT. EQP. TRIG. NODES

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 23 - INTERNAL EQUIPMENT GROUP DEFINITIONS

CARD LD.	INTERNAL EQUIPMENT GROUP	CONT "C"	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY
01 02 03	04 05 06 07 08 09 10	11	12 13 14 15 16 17	18 19 20 21 22 23	24 25 26 27 28 29 30	31 32 33 34 35	36 37 38 39 40 41	42 43 44 45 46 47	48 49 50 51 52 53	54 55 56 57 58 59	60 61 62 63 64 65	66 67 68 69 70 71
23			HEADER		RECORD							
	GROUP1		GUN	1								
	GROUP2		GUN	0								
	GROUP3		CAMERA	3								
	GROUP4		CAMERA	2								

FIGURE 8-15. FORM 23 PREPARATION EXAMPLE - INT. EQP. GROUP. DEF.

IX. SAMPLE PROBLEM 3.5

The problem described in this chapter is a complete sample package including the network drawings, completed applicable forms filled in, input processing results, and sixty day simulation run exercising many of the run options. Post processor results based upon this simulation are presented in Chapter V and include sample output products from each of the post processors. Sample problem #3.5 was developed as an update to sample problems (#1, 2, and 3) previously described in LCOM I and LCOM II user documentation. With only minor changes to these previous sample problems, many of the new features including configuration management are being exercised.

A. Purposes

The purposes for including sample problem #3.5 in this users guide are:

1. To provide guidance in the development of any data package and in the use of many of the features and options.

2. To provide a complete package as a tool for implementation of the LCOM II simulation software on another computer system.

3. To provide a set of examples of completed forms, option use, reports available and their format.

B. General Description

This problem describes the use and repair of a particular aircraft. It contains a fairly thorough description of its operations in terms of a network of flight line tasks. It describes the aircraft maintenance network in detail only on two of the aircraft systems, where one, the hydraulics, is maintained to the first indenture and the other, the communications, is maintained to the second indenture.

The hydraulic system has two subsystems, H1 and H2, which are removed and replaced on the aircraft and subsequently repaired or sent to depot for replacement.

The communications system has only one subsystem, C1, which is removed and replaced on the aircraft. Subsystem C1's repair consists of removing and replacing one or both of its major assemblies, C11 and C12, which are subsequently repaired or sent to depot for replacement.

This problem is primarily an enhanced version of the example problem used in the RAND Memorandum RM-5544-PR describing LCOM. This example is Figure 2 on page 13 of that publication.

Another interesting note is that basically this is the test package originally developed to aid in the testing and debugging of the original LCOM during its development effort. Only minor changes have been made to selectively test newer options. This is important to those users implementing the model on a different computer. Approximately 90 percent of all code is processed by this sample problem. This problem is constantly being used as a test case for checking out additional modifications to LCOM II. To enhance testing a second, but similar, aircraft has been added. It processes one of the Pre-sortie networks and the same Post-sortie network used by the original aircraft.

C. Features Used/Not Used

The following provides a summary of the LCOM II features used and not used within this sample problem. Of the features used, many of them will be discussed within the next sub-section, Problem Development.

Features Used	Features Not Used
Activities for aircraft	PSR partitioning
Network selection modes A,C,D,E,F,H,I,J,K,R,S & T	Network selection modes B and G
Generating non-aircraft resources	Generating aircraft resources
Consuming non-aircraft resources	Consuming aircraft resources
Failure mechanism	Multiple Hit Matrices
Halt mechanism	Air aborts
Shift mechanism	Task substitution on a calander basis
Tail number tracking	TACMOD
Configuration Management both internal and external	SECIN scheduled
	FACTOR
Priority system (Defaults)	Dump & Restart
Aircraft timing switch	Air Abort Control
Attrition	
RAM repair	
Initial aircraft assignment change	
Warmup	
Time Controlled activitity processing	
Aircraft tracking	
Use of Empirical Distributions	
Multiple aircraft	
General resource substitution	
Task Specific resource substitution	
Task substitution on a daily basis	
Spare Aircraft assignment control	
Expanded Node Usage Report	

D. Problem Development

In this chapter, the figures and tables are explicitly ordered for the purpose of sequentially representing the completed forms as they would be submitted and the output products as they would be produced. References to these are often not in a similar sequence but better represent data development sequence.

1. Data Plot

Once the problem was defined, the first and most logical step was to draw the network in detail including the necessary task data. Figure 9-1 is a computerized plot of the complete Sample Problem's network. It is divided in five parts which are:

a. Part 1 - Entry point/flight line network

b. Part 2 - Call Sections networks

c. Part 3 - Unscheduled maintenance network

d. Part 4 - Internal Equipment/Repair and Reconfiguration networks.

e. Part 5 - External Reconfiguration networks.

This plot provides a sure method of visual audit of the networks and enables the modification of erroneous data. From these networks, as drawn, Form 11 and part of Form 12 could be filled out directly. Reference Figures 9-5 and 9-4 respectively. The following are further comments about each form.

2. Form 10 - Report Specifications. Reference Figure 9-2. After making a general description, the operations environment (flying program) cards subtype 3 and 5 were completed. Information on cards subtype 7, 9 and 11 came from a review of the networks and the general format of the Performance Summary Report desired. Since this problem is small, we needed less than 10 columns in any of the report sections, but we could have easily required more had the problem size demanded it.

3. Form 11 - Task Networks. Reference Figure 9-5. The network as defined in Figure 9-1 was placed on this form. A general network naming convention was followed. All mission pre-sortie networks are entered at nodes beginning with the Letter B. The unscheduled maintenance network is entered at Node G. An activity network is entered at Node A. External reconfiguration networks are entered at Nodes beginning with the Letter Q. The internal reconfiguration network is entered at Node R1. Ordnance down loading networks are entered at nodes beginning with the characters RS., and ordnance resupply networks begin with the characters ORD. Finally the three primary call sections are entered at Nodes D, E, and F.

4. Form 12 - Task Definition. Reference Figure 9-4. The tasks to be defined on the Form 12s are specified in the Form 11 networks. Note the pump consumption on the REPLH1 task. In order to begin processing on the pump itself (next indenture) and ensure that the pump repair time had no effect on the aircraft, we generated a PUMPH1 on the INSPH1 task. Had we desired to have the pump repair process completed but not specifically follow the pump itself, we would still have an asterisk in Column 29 (generate) but no associated resource described. This precludes any effect between indenture activity. This generate action has the effect of separating the repair network (off equipment) from the aircraft network (on equipment), thereby, not impairing the aircraft availability. A similar effect between each indenture is also accomplished by a generate action. The resupply and other off equipment ordnance actions are also triggered through a generate task.

Both general and task specific resource substitution was activated through the use of Form 12A records and their companion Form 13 defined substitutions. Post-flight task POSFLT has two task specific alternate crews specified with general substitution permitted on the last POSFLT's 12A record.

Note that a man resource GENTEC, general technician, was defined on Form 13 and had most other defined men resources defined as general substitutes for it. On the Form 16s a shift authorization of zero was specified for these GENTECs on all shifts. The net effect of this action was to force "task assist" resource substitution any time a requirement for a GENTEC was requested. When using this technique, the general substitution flag on Form 12/12A (Column 43, 52, or 61) must be used. If not, and there is no authorized quantity of the resource (GENTEC in this example), that set of resource requirements can never be satisfied. The associated task would never start unless other alternate crews are specified.

5. Form 13 - Resource Definitions. Figure 9-3. For each resource identified as a task requirement on Form 12, additional information was developed. The "report column" specified correlates to the information on Form 10, Figure 9-2. An "authorized quantity" was assigned to only those resources not described on Form 16, Figure 9-8. These were assigned shift quantities on that form. Note that on Form 13, separate clocks were identified for each of the four major parts H1, H2, C11, and C12. The hydraulic systems failure processing was controlled at subsystem level by failure clock H1 and H2. The communication systems failure processing was controlled by the assemblies C11 and C12, not by subsystem C1. Clocks CLKBMS, CLKSMT, and CLKMIS are ordnance halt clocks used to control the resupplying of ordnance within the sample problem. Clocks CK2BMS, CK2SMT, and CK2MIS are ordnance halt clocks used to control ordnance handling during reconfiguration down loading. Camera Clock CLKCAM will be used in the processing of the internal equipment camera.

6. Form 14 - Clock Decrements. Figure 9-6. Here we defined that the SORTIE task when accomplished was to decrement the Hydraulic System clocks H1 and H2 by the sortie length. Since a particular task can decrement clocks only one way, we defined an additional task of no time duration

(DCRMT) in the pre-sortie networks for the express purpose of decrementing the communications subsystem clocks by a constant of one for each sortie completed. The camera clock decrement task, DFCAM, is processed post-sortie on certain missions. Tasks DECBMS, DECSMT, DECMIS, DCBM52, DCSMT2, and DCM152 decrement their appropriate halt clocks for proper ordnance control.

7. Form 15 - Distributions. Figure 9-7. Two empirical distributions were defined, one interpolate, and one step function. One is used in defining a clock failure parameter distribution and the other defines a task time distribution.

8. Form 16 - Shift Change Policies. Figure 9-8. Two shift patterns were defined; the first represents a seven-day week with standard 8-hour shifts, the second represents a continuous daily cycle with 9, 8 and 7-hour shifts used for munitions specialists and camera technicians. The associated resource authorization quantities on each shift are given for each resource.

9. Forms 17, 21, 22, and 23. Figures 9-9, 9-10, 9-11 and 9-12

a. Configuration Management

To the degree possible, a narrative description of the data development and analysis process will be given followed by an explanation of the forms required to implement Configuration Management. The first step is an in-depth analysis of all possible external and internal configurations. Once defined, an attempt to consolidate them into as few different configurations as possible was made. The ground rules for the consolidation process should include, but not be limited to, consideration of the following five questions.

(1) What types of answers or results am I looking for and what impact will the different configurations have on these results? Areas of prime consideration include tasks with significantly different times or crew sizes, operational substitutability, etc.

(2) How many of the possible configurations are actually used and to what extent? It may be that 25 different configurations are possible but only 6 or 7 constitute 95% of all the missions flown.

(3) During the process of configuration changes (reconfigurations), are there special requirements for checkout of the configurations, i.e., special tasks or resources required?

(4) In terms of internal configurations, are there any special networks to be developed and what impact might they have on aircraft availability?

(5) What impact will reconfigurations have on aircraft pre-sortie time?

b. External Configurations

For the purpose of describing the primary aircraft, let's first consider only the external configurations. Analysis has allowed us to consolidate the number of external configurations down to 6: (a) CLEAN (no ordnance or weapon rack(s), (b) BMS500 (conventional 500 lb bombs with racks), (c) MISSLS (missiles with racks), (d) SMTBMS (smart bombs with racks), (e) RACKS only and (f) RECPOD (reconnaissance pods with racks). Table 9-1 is the Aircraft External Reconfiguration Matrix which depicts the time and munitions load crew requirements, plus the time and crew chief requirements, necessary to transform an aircraft from one external configuration to another. This matrix can be used, along with advice from experienced maintenance personnel, to then develop the next data requirements - the entry points, search patterns, and reconfiguration networks.

TABLE 9-1. AIRCRAFT EXTERNAL RECONFIGURATION MATRIX[a]

PRE-SORTIE CONFIGURATION	FOUND CONFIGURATION: CLEAN	BMS500	MISSLS	SMTBMS	RACKS	RECPOD	DEFINES[c] SEARCH PATTERN
CLEAN	-0-	1.2/4[b] .3/2	1.0/4 .3/2	1.0/4 .3/2	.3/2	.4/4 .3/2	RECON1
BMS500	1.0/4 .50/2	-0-	1.0/4 1.0/4	1.0/4 .9/4	1.1/4	.4/4 1.0/4	RECON5[d]
MISSLS	1.1/4 .50/2	11.2/4 11.1/4	-0-	1.0/4 1.1/4	1.2/4	.4/4 1.1/4	RECON3
SMTBMS	1.2/4 .50/2	1.0/4 1.2/4	1.0/4 1.0/4	-0-	1.2/4	.40/4 1.2/4	RECON4[e]
RECPOD	1.0/4 .50/2	1.2/4 1.0/4	1.0/4 1.0/4	1.0/4 1.0/4	1.0/4	-0-	RECON6[f]

Notes:

a. Values in table are: task time in hours/crew sizes

b. All crew size of 4 require munitions load crews and crew size of two require crew chiefs.

c. Reconfiguration networks specified for this search pattern will, when processed, result in the configuration noted in col 1.

d. This search pattern was redefined and modified as RECON2 for internal Configuration Management.

e. This search pattern was redefined and modified as RECON7 for internal Configuration Management.

f. This search pattern was modified for internal Configuration.

The action necessary to utilize the data in Table 9-1 were as follows:

(1) During Form 17 preparation, the proper search pattern was selected based upon both mission need and reconfiguration timing. Proper entries into the network based upon pre-sortie processing requirements are reflected in Figure 9-1, Part 1. The PREFLT activity uses the default search pattern (name the same as the aircraft) because this search pattern must, by definition, search all external configurations. Internal configuration should not be considered in this search pattern. Note that since PREFLTs are activities, we are not collecting statistics on them in the PSR (no column assignment).

(2) Pseudo-preparation of the Search Pattern definitions, Form 21, was then accomplished considering only the external configuration. Addition of internal configuration data requirements followed prior to actually filling out Form 21. Section D9c discusses the Internal Configuration data development.

(3) Within the Form 11s there should be defined new or modified network sections

describing the external reconfigurations for the seven search patterns, RECON1 through RECON7. These reconfiguration networks are found in Figure 9-1, Part 5. The associated Form 11s are shown in Figure 9-5.

(4) New tasks must also be defined on the Form 12 (see Figure 9-4). These tasks are those used in the above networks.

(5) In the sample problem each mission was given its own entry point (See figure 9-1, Part 1). This was done in order to simplify the example and to show the consumption and generation of the appropriate ordnance. This need not always be the case, however. If the missions are of a similar nature, they can both utilize the same entry point. In cases involving different mission types, the networks can be drawn as in the sample problem with each mission having its own entry point, or if desired, one basic flight line/mission processing network leading to a sortie with separate networks following the sortie showing consumption and generation of the appropriate ordnance. This procedure will, of course, require clocks and various combinations of the H, J and possibly K selection modes to control the entry into the proper post sortie network section at the proper time. However, the addition of internal configurations also is made less complicated when separate Mission entry points and pre-sortie networks are used.

(6) The second aircraft was defined as having only one configuration, CLEAN.

c. Internal Configuration (applies only to the original aircraft)

Given the above resolution of external configuration, an analysis was made of the internal configuration usage. On Forms 21 and 23, a camera was defined as the internal equipment on the F4D aircraft for three missions: INTRD1, RECON, and INTRD3. At the start of simulation, one camera as authorized on Form 22 is placed on the aircraft. Within each search pattern that considers internal configuration, a check is made first to locate aircraft configured with one camera (see Table 9-1 and Forms 21 and 23). If enough aircraft are located, then a check is made for aircraft configured with Ø cameras. When these aircraft are located, they must be internally reconfigured to contain one camera by processing the internal reconfiguration network defined on Form 11 with the Reconfiguration Entry Node specified on Form 21. The internal reconfiguration network is shown in Figure 9-1, Part 4 with entry node R1.

The use of trigger node ADDCAM is specified in the internal reconfiguration network and is implemented to add one camera to the internal equipment on those aircraft which contain Ø cameras. The "add" action of ADDCAM trigger node is defined on Form 22. The trigger node SUBCAM causes the opposite action to take place, that of subtracting one camera from the internal equipment on an aircraft and is also shown in the network in Figure 9-1, Part 3 beginning with entry node G. This maintenance network will be processed when the camera clock CLKCAM breaches zero.

In the unscheduled maintenance network the task used at node SUBCAM "generates" a camera "part" for shop repair, thus making the camera a supply item, as well as internal equipment. The camera is not replaced on the aircraft during unscheduled maintenance, i.e., no consume demand is made for the camera. However, in the reconfiguration network, the task used at node ADDCAM does consume the camera. When using Internal Configuration equipment, consume and generate actions are not required, but if used, permit the internal equipment items to be reported in several of the Main Module reports including the PSR, This provides for easier checkout of Internal equipment trigger node usage.

Caution: Care should be taken to not process either the plus or minus trigger nodes in a manner where the maximum authorized is exceeded, or the internal equipment quantity becomes negative.

10. Form 20. Figure 9-13. The primary record of importance here is the second card on which we have asked for a mission and sortie listing (LIST) to be made as well as the exogenous tape normally produced. Also we established that only a 60-day flying program be generated and gave our code identifier 3.5 .BL (sample problem #3.5, baseline exogenous file) to the Input Module. The remainder of the data records are used to generate the flying program.

One option not mentioned before is used on the activity PREFLT (pre-flight). Here we wish to cause all aircraft not currently in use to do the particular pre-flight inspection task. By placing a "99" in the maximum mission size, the simulation model knows that only those aircraft not currently in use are to do this task. All other numbers placed in these size columns are demands for explicit quantities of aircraft. A cancel time of 3.5 hours was given for this activity which was to begin at 0300, therefore, if any of the aircraft required to do this PREFLT task have not started by 0630, the activity for that aircraft will be cancelled.

E. Input Module Processing.

See Chapter III for a description of each report. Figures 9-14 to 9-39 represent the Input Module printout for the sample problem as submitted. Additional pages of particularly long reports have been omitted. Each report is primarily a listing of the data records with expanded spacing between the entries. Sequence number would have been printed at the right of each report if the sample problem records had been sequence numbered. Sequence numbers, however, are a significant aid in data base changes especially when the data package is large. See Chapter III, Section G, for report description.

Normally while developing a package, embedded diagnostics are prevalent, but on a completely clean package such as this, only warning and informational messages are embedded. However, summary diagnostics and messages are always given as in Figure 9-28 and 9-29.

Figures 9-30 through 9-38 are the dictionaries containing the numbers assigned to the particular resource, clock or task, etc. Figure 9-39 is only a partial of the Initialization data report since this report is voluminous. Programming knowledge is required for its interpretation. The first part of it shows the transfer of the necessary dictionaries to the Main Module and Post Processor Module.

F. Main Module Processing

The problem was simulated for 60 days with a 10 day warmup. Within this run, a sample of all normal and optional reports was requested. These reports were scattered throughout the chapter only for the intended purpose of proper spacing to allow two page reports to be properly displayed, therefore they may seem out of sequence.

General discussion on some of the reports in Figures 9-40 through 9-54 follows.

Initialization - Figure 9-41. This is the Main Module printout of the initialization produced by the Input Module and is provided only to show its existence. Programming knowledge is necessary to completely understand this report. The report itself is voluminous and only partially displayed.

Change Cards - Figure 9-42. This report reflects all the changes we requested during this run. See Chapter VII for CHANGE card descriptions.

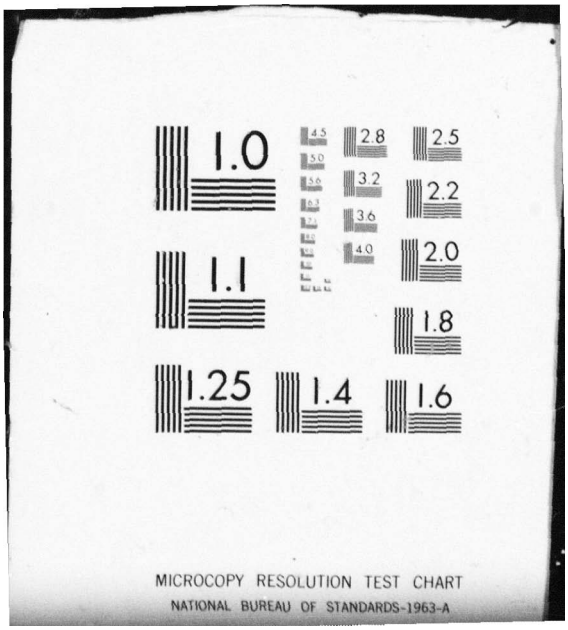
Figures 9-43 through 9-54 are specific Main Module reports either requested in the change card file or provided automatically at specified frequencies and as such should be self-explanatory. Reference Chapter IV, Section D, for report descriptions.

Figure 9-55 is an example of a main module run abort and has no relationship to the remaining figures. It was a forced abort included only to show a sample of the abort traceback reports for

AD-A083 759 AIR FORCE MAINTENANCE AND SUPPLY MANAGEMENT ENGINEERI--ETC F/G 9/2
LCOM II SIMULATION SOFTWARE USERS REFERENCE GUIDE,(U)
OCT 79 W F DRAKE, R C REISS
UNCLASSIFIED AFMSMET-78-5.1 NL

3 OF 5
AD A083759




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

identification purposes.

G. Summary

This sample problem has a complete set of output reports shown here. The Main Module results obtained during implementation on another computer will only be similar to but not duplicated in content, since the simulation is based upon random draws. However, all Input Module processing, Figures 9-14 through 9-39, and Figures 9-40 through 9-42 of the Main Module processing should be duplicated.

The sample itself must not be considered a good representation of some base activity or maintenance but serves as an excellent example data package. The Main Module run processed is a constrained case. This was done to force certain reports, such as the backorder status (BOSTAT) report to contain information for illustrative purposes.

All transaction data has been tapped out for use by the Post Processor Module. However, the reports from the various post processors are not included in this chapter, but samples of them are included in Chapter V along with a description of the specific post processor.

SAMPLE PROBLEM #3.5 15 JAN 79

CONSTRAINED CASE RESULTS

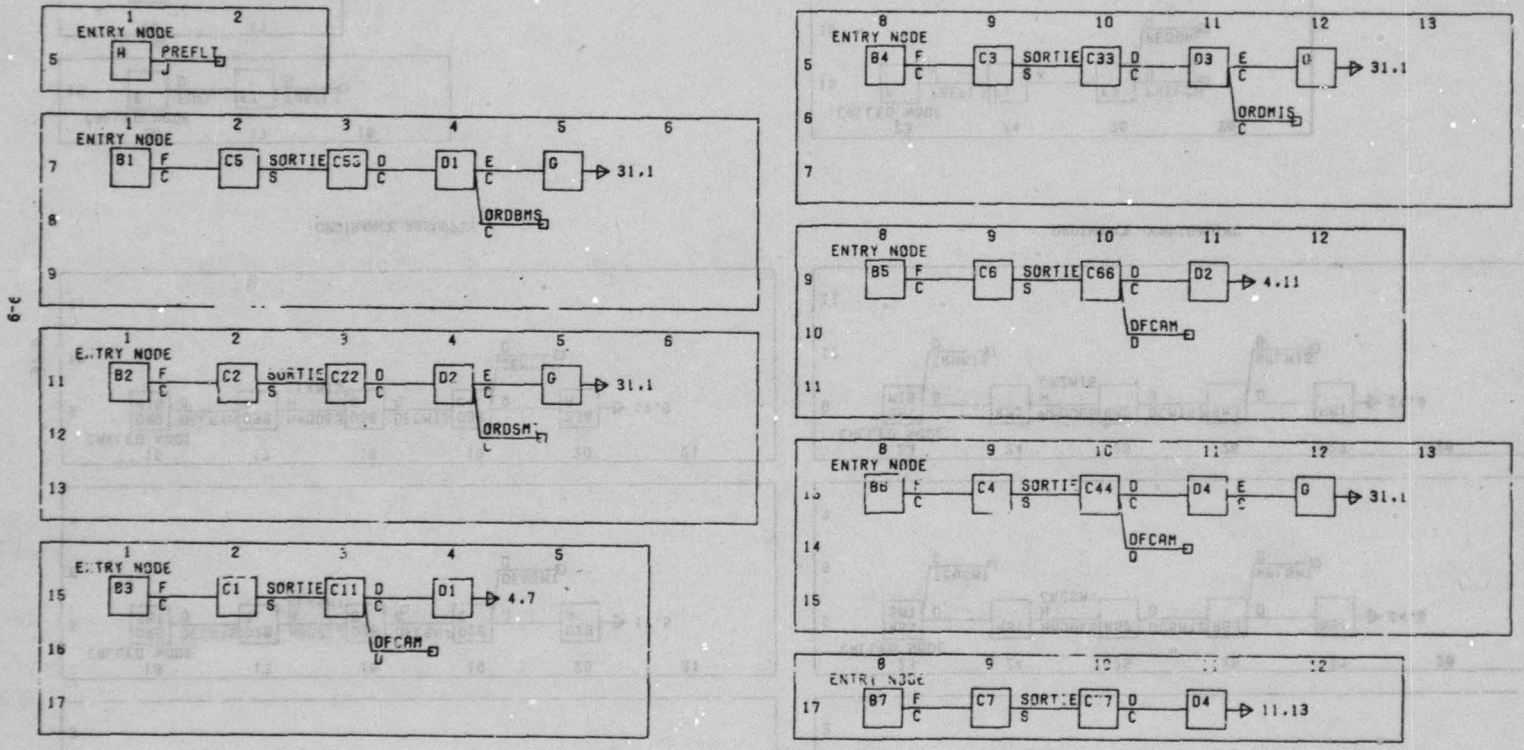
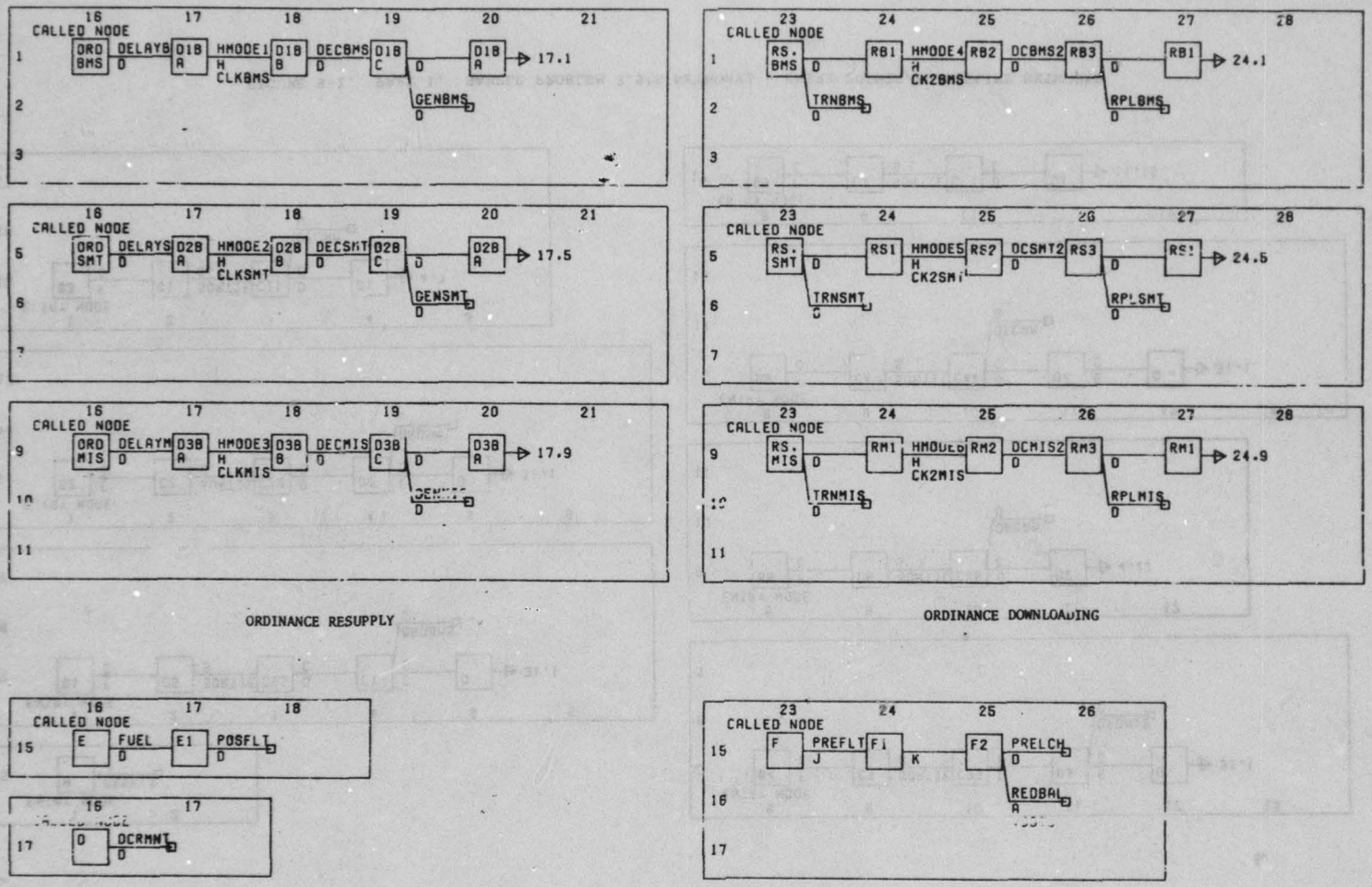


FIGURE 9-1. PART 1. SAMPLE PROBLEM 3.5'S NETWORKS - ENTRY POINTS/FLIGHTLINE NETWORKS



ORDINANCE RESUPPLY

ORDINANCE DOWNLOADING

FIGURE 9-1. PART 2. SAMPLE PROBLEM 3.5'S NETWORKS - CALL SECTIONS

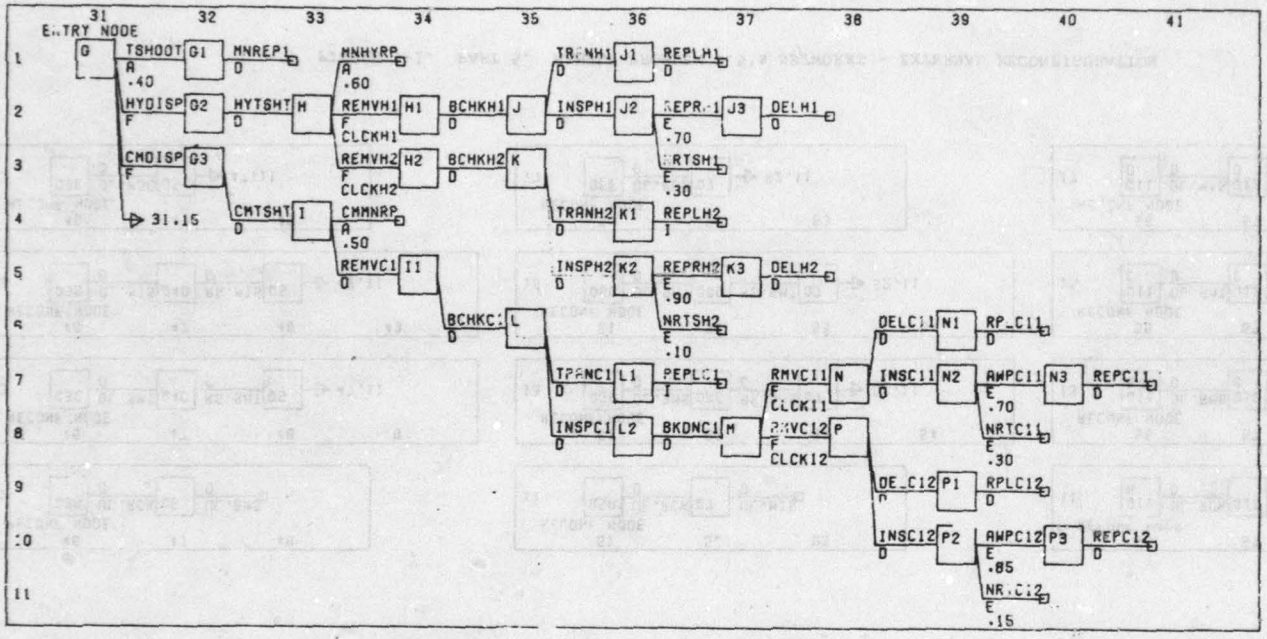
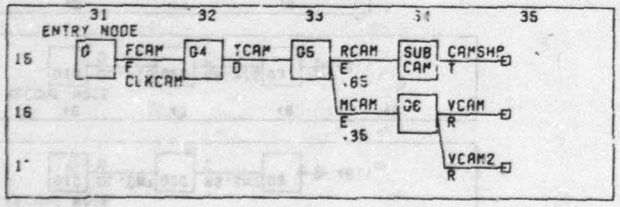
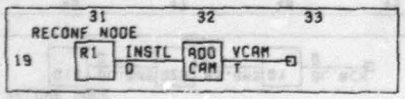


FIGURE 9-1 PART 3. SAMPLE PROBLEM 3.5'S NETWORKS - UNSCHEDULED MAINTENANCE



CAMERA REPAIR



CAMERA RECONFIGURATION

FIGURE 9-1. PART 4. SAMPLE PROBLEM 3.5'S NETWORKS - INTERNAL CONFIGURATION

SAMPLE PROBLEM 3.5

INDEX OF BEGINING NODE LOCATIONS. (X,Y COORDINATES) X = HORIZONTAL. Y = VERTICAL

ENTRY NODES

G	31.15
G	31.1
A	1.5
B1	1.7
B2	1.11
B3	1.15
B4	8.5
B6	8.13
B7	8.17
B5	8.9

CALLED NODES

F	23.15
D	16.17
E	16.15
ORDBMS	16.1
ORDSMT	16.5
ORDMIS	16.9
RS.BMS	23.1
RS.MIS	23.9
RS.SMT	23.5

RECONF NODES

Q1B	46.1
Q1D	46.5
Q1C	46.3
Q1E	46.7
Q3A	46.11
Q3D	46.15
Q3C	46.13
Q3E	46.17
Q4A	51.1
Q5A	51.11
Q5C	51.13
Q5D	51.15
Q5E	51.17
Q7A	56.1
Q7C	56.3
Q7D	56.5
Q7E	56.7
Q11A	56.11
Q11B	56.13
Q11D	56.17
Q11C	56.15
R1	31.19

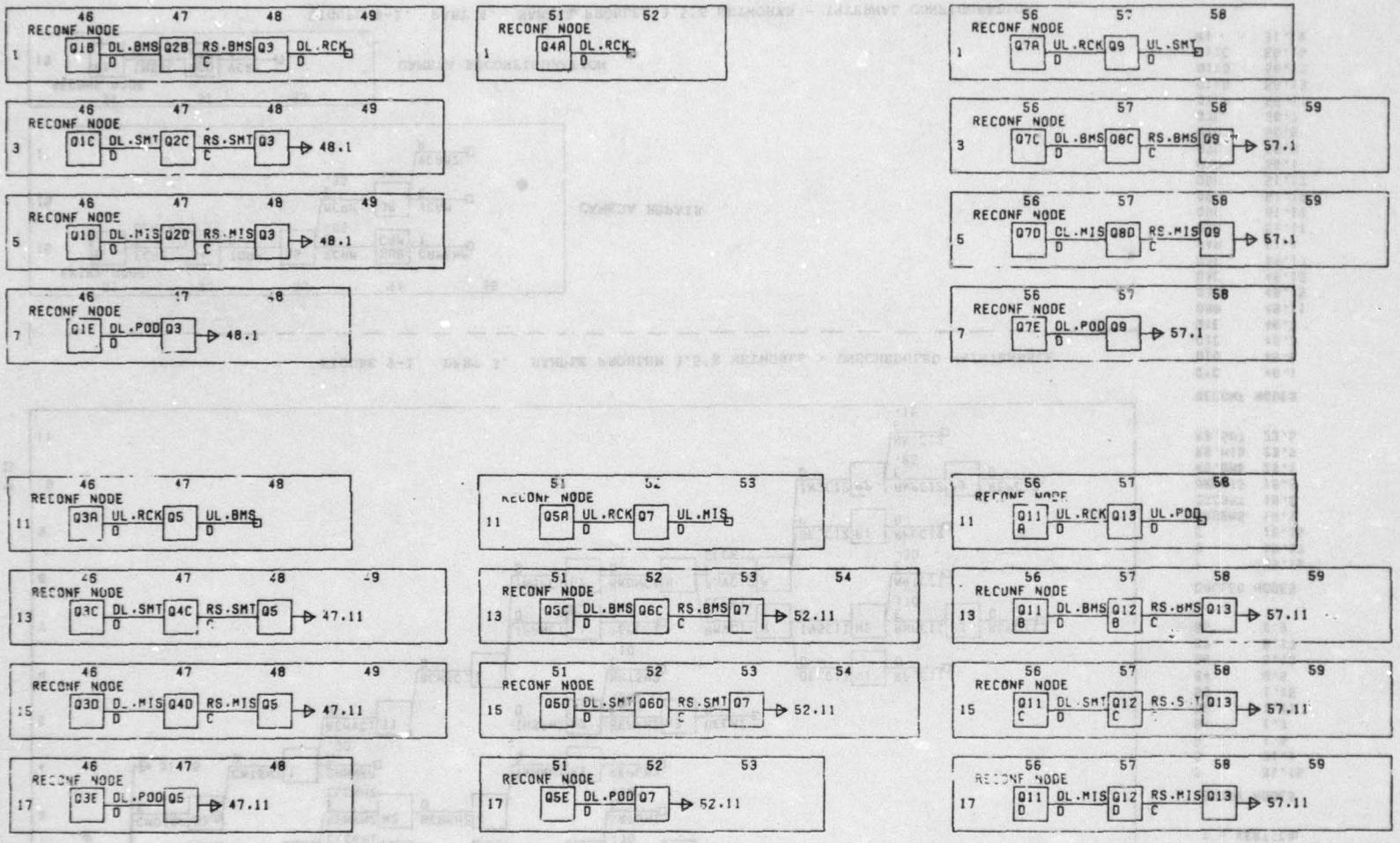


FIGURE 9-1. PART 5. SAMPLE PROBLEM 3.5's NETWORKS - EXTERNAL RECONFIGURATION

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 10 - PERFORMANCE SUMMARY REPORT

02 03 | 1 0 REPORT SPECIFICATIONS — SAMPLE PROBLEM # 3.5

04 05 | 0 1 THE REPORTING CYCLE TIME IS 07 08 09 10 | 1 D . EVERY 13 14 | 7 CYCLES, A SUMMARY REPORT IS PRODUCED.

04 05 | 0 3 IN THE OPERATIONS AREA, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
RECON	INTRD1	CLSPT1	CLSPT2	INTRD2	INTRD3	FERRY1	FERRY2		

04 05 | 0 5 FOR AIRCRAFT, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
FLD	F+D.1								

04 05 | 0 7 IN THE MAINTENANCE AREA, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
CREWC	HOMPERS	FLTENG	HYDTEC	HYDSPL	COMTEC	COMSPL	MUNSPL	CAMTEC	

04 05 | 0 9 FOR SUPPLY STATISTICS THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
PUMPH1	PUMPH2	RDASSY	RADC11	RADC12	BMS50	SMTBMS	M1SSLS	CAMERA	

04 05 | 1 1 FOR EQUIPMENT ITEMS, THE APPROPRIATE COLUMN HEADINGS ARE:

1	2	3	4	5	6	7	8	9	10
TRUCK									

04 05 | 1 3 THE RUN NAME FOR THIS INITIALIZATION IS:

1
SP3.5T

FIGURE 9-2. SAMPLE PROBLEM 3.5's FORM 10

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 13 - RESOURCE DEFINITIONS

CARD I.D.	RESOURCE I.D.	ENTRY	RES. TYPE	REPORT COLUMN	UNIT COST	AUTH. QTY	SUBSTITUTE RESOURCE	FAILURE RATE MEAN	FAILURE RATE VARIANCE	FAILURE RATE DIST	SUBSTITUTE RESOURCE	SUBSTITUTE RESOURCE	SUBSTITUTE RESOURCE
13	FAD		I	1	1KK	18							
	CREWCH		M	1	8000								
	OMPERS		M	2	7500								
	FLTENG		M	3	7500								
	HYDTEC		M	4	7000		HYDSPL						
	HYDSPL		M	5	4500		HYDTEC						
	COMTEC		M	6	7000								
	COMSPL		M	7	6500								
	MUNSPL		M	8	6500								
	TRUCK		A	1	6000	1							
	PUMPH1		P	1	100	1							
	PUMPH2		P	2	100	1							
	RDASSY		P	3	1000	0							
	RADC11		P	4	500	1							
	RADC12		P	5	500	1							
	BMS500		P	6	1000	800							
	SMTBMS		P	7	18000	250							
	MISSLS		P	8	14000	100							
	CLCKH1		C					100H		C			
	CLCKH2		C					*444					
	CLCK11		C					50H	5H	X			
	CLCK12		C					50H		C			
	CLKBMS		C					8		C			
	CK2BMS		C					8		C			
	CLKSMT		C					4		C			
	CK2SMT		C					4		C			
	CLKMIS		C					4		C			
	CK2MIS		C					4		C			
	CLKCAM		C					5		C			
	CAMTEC		M	9									
	CAMERA		P	9	2600	3							
	GENTEC		M	10	5000		COMTEC				HYDSPL	CREWCH	OMPERS
	GENTEC						FLTENG				HYDTEC	COMSPL	MUNSPL
VV	FAD.1		I	2	1KK	3							

◉ RESOURCE TYPE: I = Aircraft, P = Parts, M = Men, A = AGE, or Facilities
◒ An * indicates resource can enter network.
○ Triangular distribution not allowed on this form.
◓ Applicable to Model Version 3.0.

FIGURE 9-3. SAMPLE PROBLEM 3.5's FORM 13

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

CARD I.D.	Blank or A ○	TASK I.D.	Cont. "C" ◉	Task Type ◉	Priority	TASK DURATION: MEAN (OPTIM) ◒	TASK DURATION: VARIANCE (LIKELY) ◒	DIST	*	ASSOCIATED RESOURCE/ RCS ◑	TASK RESOURCE REQUIREMENTS: RESOURCE	C	QTY.	RESOURCE	C	QTY.	RESOURCE	C	QTY.	TRIANGULAR DISTRIBUTION (PESSIMO) ◒
12																				
		PREFLT		31		1.ØØH		C			CREWCH		1							
		PRELCH		31		.3ØH	.Ø3H	N			CREWCH		1							
		SORTIE		11																
		FUEL		31		.17H		C			OMPERS		2							
		DCRMNT		51																
		POSFLT		31		1.ØØH	Ø.1H	L			OMPERS		3							
	A	POSFLT								FCT11	OMPERS		2	CREWCH		1				
	A	POSFLT								FCT22	OMPERS		1	CREWCH		1	GENTECX		1	
		HMODE1		51																
		HMODE4		52																
		DECBMS		51																
		DCBMS2		52																
		GENBMS		41					*	BMS5ØØ										
		DELAYB		51		12D	1.2DL		*											
		HMODE2		51																
		HMODE5		52																
		DECSMT		51																
		DCSMT2		52																
		DELAYS		51		12D	1.2DL		*											
		GENSMT		41					*	SMT3MS										
		HMODE3		51																
		HMODE6		52																
		DECMIS		51																
		DCMIS2		52																
		DELAYM		51		12D	1.2DL		*											
		GENMIS		41					*	MISSLS										
		TSHOOT		21		15M	3ØMT				FLTENG		1							45M
		MNREP1		21		*777					FLTENG		1							
		HYDISP		21		25M	5MN				HYDTEC		2							
	A	HYDISP								FCT41	HYDTEC		1	HYDSAL		1				
	A	HYDISP									HYDTECX		1	GENTECX		1				
		HYTSHT		21		45M		C			HYDTEC		2							

◉ TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only, 6 = Condemned, 7 = First base repair (treated as unscheduled.)

◒ For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.

○ Applicable to Model Version 3.0.

◑ Resource Combination Set (Form 12A)

FIGURE 9-4. SAMPLE PROBLEM 3.5's FORM 12

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

CARD I.D.	Blank or A ○	TASK I.D.	Cont "C" ◉	Task Type	Priority	TASK DURATION MEAN (OPTIM) ◒	TASK DURATION VARIANCE (LIKELY) ◒	DIST	*	ASSOCIATED RESOURCE/ RCS ◑	TASK RESOURCE REQUIREMENTS RESOURCE	C	QTY.	RESOURCE	C	QTY.	RESOURCE	C	QTY.	TRIANGULAR DISTRIBU-TION (PESSIM) ◒
12	A	HYTSHT								FCT4										
		REDBAL		21		.25H		C												
		ANHYRP		21		1H	30M	N			HYDSPLX		2							
		REMYH1		21		30M	3ML				HYDSPLX		1							
		BCHKH1		21		30M	3ML				HYDSPLX		1							
		TRANH1		21		10M	5MN				HYDSPLX		1	TRUCK		1				
		REPLH1		21		30M	3ML				PUMPH1	C	1	HYDSPLX		1				
		INSPH1		22		1.5M	5MN		*	PUMPH1	HYDSPL		1							
		REPRH1		72		4.5M	5ML				HYDSPL		1							
		DELH1		22		1D	12HN													
		NRTSH1		H2		20D	6DN													
		REMYH2		21		30M	10ML				HYDSPLX		1							
		BCHKH2		21		30M	10ML				HYDSPLX		1							
		TRANH2		21		10M	5ML				HYDSPLX		1	TRUCK		1				
		REPLH2		21		30M	10ML				PUMPH2	C	1	HYDSPLX		1				
		INSPH2		22		1.5M	2ML		*	PUMPH2	HYDSPL		1							
		REPRH2		72		4.5M	5ML				HYDSPL		1							
		DELH2		22		2D	12HN													
		NRTSH2		42		20D	6DN													
		CMDISP		21		15M	5MN				COMTEC		1							
		CMTSHT		21		45M	15MN				COMTEC		2							
		CMMNRP		21		1H	30MN				COMTEC		2							
	A	CMMNRP								FCT31	COMTEC		1	GENTECX		1				
		REMYC1		21		30M	3ML				COMTEC		2							
	A	REMYC1								FCT31										
		BCHKC1		21		1H	15MN				COMTEC		1							
		TRANC1		21		10M	5MN				OMPERS		1	TRUCK		1				
		REPLC1		21		30M	3ML				RDASSYC		1	COMSPL		1				
		INSPC1		22		15M	1.5ML		*	RDASSY	COMSPL		1							
		BKDNC1		72		30M	3ML				COMSPL		1							
		RMVC11		22		30M	3ML				COMSPL		1							
		DELC11		22		10M	5MN				COMSPL		1							
		RPLC11		22		30M	10MN				COMSPL		1	RADC11C		1				

◉ TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only, 6 = Condemned, 7 = First base repair (treated as unscheduled.)

◒ For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.

○ Applicable to Model Version 3.0.

◑ Resource Combination Set (Form 12A)

FIGURE 9-4. SAMPLE PROBLEM 3.5's FORM 12 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

CARD I.D.	Blank or A ○	TASK I.D.	Cost ¢/C**	Task Type ◉	Priority	TASK DURATION: MEAN (OPTIM) ◒	TASK DURATION: VARIANCE (LIKELY) ◒	DIST	*	ASSOCIATED RESOURCE/ RCS ◑	TASK RESOURCE REQUIREMENTS: RESOURCE	C	QTY.	RESOURCE	C	QTY.	RESOURCE	C	QTY.	TRIANGULAR DISTRIBUTION (PESSIM) ◒
01 02	03	04 05 06 07 08 09 10	11	12	13	14 15 16 17 18 19 20	21 22 23 24 25 26	27	28	29 30 31 32 33 34 35	36 37 38 39 40 41 42	43	44 45	46 47 48 49 50 51 52	53	54	55 56 57 58 59 60	61	62 63	64 65 66 67 68 69 70
1 2		INSC11		2	2	1 5M	1.5ML		*	RADC11	COMSPL		1							
		AWPC11		7	2	4 5M	15MN				COMSPL		1							
		REPC11		2	2	4 5M	4.5ML				COMSPL		1							
		WRTC11		4	2	2ØD	6DN													
		RMVC12		2	2	3ØM	3ML				COMSPL		1							
		DELC12		2	2	1ØM	5MN				COMSPL		1							
		RPLC12		2	2	3ØM	3ML				COMSPL		1	RADC12	C	1				
		INSC12		2	2	1 5M	1.5ML		*	RADC12	COMSPL		1							
		AWPC12		7	2	4 5M	4.5ML				COMSPL		1							
		REPC12		2	2	4 5M	4.5ML				COMSPL		1							
		NRTC12		4	2	2ØD	6DN													
		DL.BMS		2	1	1.2ØH	.12HL				MUNSPL		4							
		RPLBMS		7	2				*	BMS5ØØ										
		TRNBMS		2	2	.5H		C	*		TRUCK		1	MUNSPL		1				
	A	TRNBMS									GENTEC	X	1							
		DL.MIS		2	1	1.ØH	.1HL				MUNSPL		4							
		RPLMIS		7	2				*	MISSLS										
		TRNMIS		2	2	.5H		C	*		TRUCK		1	MUNSPL		1				
	A	TRNMIS									GENTEC	X	1							
		DL.SMT		2	1	1.ØH	.1HL				MUNSPL		4							
		RPLSMT		7	2				*	SMTBMS										
		TRNSMT		2	2	.5H		C			TRUCK		1	MUNSPL		1				
	A	TRNSMT									GENTEC	X	1							
		DL.POD		2	1	.4H	.Ø4HL				MUNSPL		4							
		DL.RCK		2	1	.3H	.Ø3HL				CREWCH		2							
		UL.RCK		2	1	.5H	.Ø5HL				CREWCH		2							
		UL.BMS		2	1	1.ØH	.1ØHL				MUNSPL		4	BMS5ØØ	C	8				
		UL.MIS		2	1	1.1H	.11HL				MUNSPL		4	MISSLS	C	4				
		UL.SMT		2	1	1.2H	.12HL				MUNSPL		4	SMTBMS	C	4				
		UL.POD		2	1	1.ØH	.1HL				MUNSPL		4							
		FCAM		2	1	Ø H		C												
		TCAM		2	1	.6H	.Ø6HL				CAMTEC		1							
		RCAM		2	1	.3H	.Ø3HL				CAMTEC		2							

◉ TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only, 6 = Condemned, 7 = First base repair (treated as unscheduled.)

◒ For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.

○ Applicable to Model Version 3.0.

◑ Resource Combination Set (Form 12A)

FIGURE 9-4. SAMPLE PROBLEM 3.5's FORM 12 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

CARD I.D.	Blank or A ○	TASK I.D.	Cont "C"	Task Type ◉	Priority	TASK DURATION: MEAN (OPTIM) ◒	TASK DURATION: VARIANCE (LIKELY) ◒	DIST	*	ASSOCIATED RESOURCE/ RCS ◑	TASK RESOURCE REQUIREMENTS: RESOURCE	C	QTY.	RESOURCE	C	QTY.	RESOURCE	C	QTY.	TRIANGULAR DISTRIBUTION (PESSIM) ◒
1 2		CAMSHP		7	2	1.5H	.15HL		*	CAMERA	CAMTEC		1							
		MCAM		2	1	.2H	.02HL				CAMTEC		1							
		VCAM		2	1	.2H	.02HL				CAMTEC		2							
		VCAM2		2	2	.4H	.04HL				CAMTEC		1	OMPERS		1				
		INSTL		2	1	.5H	.05HL				CAMTEC		2	CAMERAC		1				
		DFCAM		5	1	.0H		C												
		THRFLT		3	1	.5H	.05HL				OMPERS		3							
	A	THRFLT								FCT1										
	A	THRFLT								FCT2										

◉ TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only, 6 = Condemned, 7 = First base repair (treated as unscheduled.)

◒ For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.

○ Applicable to Model Version 3.0.

◑ Resource Combination Set (Form 12A)

FIGURE 9-4. SAMPLE PROBLEM 3.5's FORM 12 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SEL MODE	SELECTION PARAMETER	TASK DESCRIPTION
11						
	A	PREFLT		J		PRE-FLIGHT
	B1	F	C5	C		CALL SECTION F FOR PREFLT AND PRELCH
	F	PREFLT	F1	J		PRE-FLIGHT IF NOT PREVIOUSLY DONE
	F1		F2	K		K SELECTION MODE
	F2	PRELCH		D		PRE-LAUNCH
	F2	REDBAL		A	.0073	REDBALL UNSCHEDULED MAINTENANCE
	C1	SORTIE	C11	S		SORTIE - INTRD1
	C11	D	D1	C		CALL SECTION D FOR CLOCK DECREMENT
	ORDBMS	DELAYB	D1BA	D		DELAY TASK TO SIMULATE DELIVERY TIME
	D1BA	HMODE1	D1BB	H	CLKBMS	H SELECTION MODE - HALTS WHEN CLKBMS EQ Ø
	D1BB	DECBMS	D1BC	D		DECREMENT CLKBMS
	D1BC		D1BA	D		LOOP
	D1BC	GENBMS		D		GENERATES ONE BOMB ON EACH LOOP
	D1	E	G	C		CALL SECTION E FOR FUEL AND POSFLT
	D1	ORDBMS		C		CALL ORDBMS TO GENERATE 8 BOMBS
	E	FUEL	E1	D		REFUEL AIRCRAFT
	E1	POSFLT		D		POST-FLIGHT AIRCRAFT
	D	DCRMNT		D		DECREMENT CLOCKS
	B2	F	C2	C		CALL SECTION F FOR PREFLT AND PRELCH
	C2	SORTIE	C22	S		SORTIE - CLSPR2
	C22	D	D2	C		CALL SECTION D FOR CLOCK DECREMENT
	ORDSMT	DELAYS	D2BA	D		DELAY TASK TO SIMULATE DELIVERY TIME
	D2BA	HMODE2	D2BB	H	CLKSMT	H SELECTION MODE - HALTS WHEN CLKSMT EQ Ø
	D2BB	DECSMT	D2BC	D		DECREMENT CLKSMT
	D2BC		D2BA	D		LOOP
	D2BC	GENSMT		D		GENERATES ONE SMTBMS ON EACH LOOP
	D2	E	G	C		CALL SECTION E FOR FUEL AND POSFLT
	D2	ORDSMT		C		CALL ORDSMT TO GENERATE 4 SMTBMS
	B3	F	C1	C		CALL SECTION F (INTRD1 SORTIE/BMS500)
	B4	F	C3	C		CALL SECTION F (INTRD2 SORTIE/MISSLS)
	C3	SORTIE	C33	S		SORTIE - INTRD2
	C33	D	D3	C		CALL SECTION D FOR CLOCK DECREMENT
	ORDMIS	DELAYM	D3BA	D		DELAY TASK TO SIMULATE DELIVERY TIME
	D3BA	HMODE3	D3BB	H	CLKMIS	H SELECTION MODE - HALTS WHEN CLKMIS EQ Ø

SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = Do task, E = Either, F = Failure controlled, G = Get one, H = Halt, I = Ignore (cannib), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

FIGURE 9-5. SAMPLE PROBLEM 3.5's FORM 11

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SEL. MODE	SELECTION PARAMETER	TASK DESCRIPTION
11	D3BB	DECMIS	D3BC	D		DECREMENT CLKMIS
	D3BC		D3BA	D		LOOP
	D3BC	GENMIS		D		GENERATES ONE MISSLS ON EACH LOOP
	D3	E	G	C		CALL SECTION E FOR FUEL AND POSFLT
	D3	ORDMIS		C		CALL ORDMIS TO GENERATE 4 MISSLS
	B6	F	C4	S		CALL SECTION F (RECON SORTIE)
	C4	SORTIE	C44	S		SORTIE - RECON
	C44	D	D4	C		CALL SECTION D FOR CLOCK DECREMENT
	D4	E	G	C		CALL SECTION E FOR FUEL AND POSFLT
	B7	F	C7	C		CALL SECTION F (FERRY SORTIE)
	C5	F	C6	C		CALL SECTION F (INTR D3 SORTIE/SMTBMS)
	RS.BMS		RB1	D		CONNECTING LINK - RESTOCK BMS500
	RS.BMS	TRNBMS		D		TRANSPORTS BMS500 TO DUMP
	RB1	HMODE4	RB2	H	CK2BMS	H SELECTION MODE - HALTS WHEN CK2BMS=0
	RB2	DCBMS2	RB3	D		DECREMENT CK2BMS
	RB3		RB1	D		INITIATES NEXT LOOP
	RB3	RPLBMS				GENERATES ONE BMS500 ON EACH LOOP
	RS.SMT		RS1	D		CONNECTING LINK - RESTOCK SMTBMS
	RS.SMT	TRNSMT		D		TRANSPORTS SMTBMS TO DUMP
	RS1	HMODE5	RS2	H	CK2SMT	H SELECTION MODE - HALTS WHEN CK2SMT=0
	RS2	DCSMT2	RS3	D		DECREMENT CK2SMT
	RS3		RS1	D		INITIATES NEXT LOOP
	RS3	RPLSMT		G		GENERATES ONE SMTBMS ON EACH LOOP
	RS.MIS		RM1	D		CONNECTING LINK - RESTOCK MISSLS
	RS.MIS	TRNMIS		D		TRANSPORTS MISSLS TO DUMP
	RM1	HMODE6	RM2	H	CK2MIS	H SELECTION MODE - HALTS WHEN CK2MIS=0
	RM2	DCMIS2	RM3	D		DECREMENT CK2MIS
	RM3		RM1	D		INITIATES NEXT LOOP
	RM3	RPLMIS		D		GENERATES ONE MISSLS ON EACH LOOP
	Q1B	DL.BMS	Q2B	D		DOWN LOAD BMS500
	Q1D	DL.MIS	Q2D	D		DOWN LOAD MISSLS
	Q1C	DL.SMT	Q2C	D		DOWN LOAD SMTBMS
	Q1E	DL.POD	Q3	D		DOWN LOAD RECPOD
	Q3	DL.RCK		D		DOWN LOAD RACKS
	Q2B	RS.BMS	Q3	C		RESTOCK 8 BMS500

SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = Do task, E = Either, F = Failure controlled, G = Get one, H = Halt, I = Ignore (cannib), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

FIGURE 9-5. SAMPLE PROBLEM 3.5's FORM 11 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SEL. MODE ●	SELECTION PARAMETER	TASK DESCRIPTION
11	Q2D	RS. MIS	Q3	C		RESTOCK 4 MISSLS
	Q2C	RS. SMT	Q3	C		RESTOCK 4 SMTBMS
	Q3A	UL. RCK	Q5	D		UPLOAD RACKS
	Q3D	DL. MIS	Q4D	D		DOWN LOAD MISSLS
	Q3C	DL. SMT	Q4C	D		DOWN LOAD SMTBMS
	Q3E	DL. POD	Q5	D		DOWN LOAD RECPOD
	Q5	UL. BMS		D		UPLOAD BMS500
	Q4A	DL. RCK		D		DOWN LOAD RACKS
	Q4C	RS. SMT	Q5	C		RESTOCK 4 SMTBMS
	Q4D	RS. MIS	Q5	C		RESTOCK 4 MISSLS
	Q5A	UL. RCK	Q7	D		UPLOAD RACKS
	Q5C	DL. BMS	Q6C	D		DOWN LOAD BMS500
	Q5D	DL. SMT	Q6D	D		DOWN LOAD SMTBMS
	Q5E	DL. POD	Q7	D		DOWN LOAD RECPOD
	Q7	UL. MIS		D		UPLOAD MISSLS
	Q6C	RS. BMS	Q7	C		RESTOCK 8 BMS500
	Q6D	RS. SMT	Q7	C		RESTOCK 4 SMTBMS
	Q7A	UL. RCK	Q9	D		UPLOAD RACKS
	Q7C	DL. BMS	Q8C	D		DOWN LOAD BMS500
	Q7D	DL. MIS	Q8D	D		DOWN LOAD MISSLS
	Q7E	DL. POD	Q9	D		DOWN LOAD RECPOD
	Q9	UL. SMT		D		UPLOAD SMTBMS
	Q8C	RS. BMS	Q9	C		RESTOCK 8 BMS500
	Q8D	RS. MIS	Q9	C		RESTOCK 4 MISSLS
	Q11A	UL. RCK	Q13	D		UPLOAD RACKS
	Q11B	DL. BMS	Q12B	D		DOWN LOAD BMS500
	Q11D	DL. MIS	Q12D	D		DOWN LOAD MISSLS
	Q11C	DL. SMT	Q12C	D		DOWN LOAD SMTBMS
	Q13	UL. POD		D		UPLOAD RECPOD
	Q12B	RS. BMS	Q13	C		RESTOCK 8 BMS500
	Q12C	RS. SMT	Q13	C		RESTOCK 4 SMTBMS
	Q12D	RS. MIS	Q13	C		RESTOCK 4 MISSLS
	G	TSHOOT	G1	A	.40	HYDRAULIC TROUBLESHOOT
W	G1	MNREPI		D		MINOR REPAIR
W	G	HYDISP	G2	F		HYDRAULIC DISPATCH

● SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = Do task, F = Either, U = Failure controlled, G = Get one, H = Halt, I = Ignore (cannib), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

FIGURE 9-5. SAMPLE PROBLEM 3.5's FORM 11 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SEL. MODE	SELECTION PARAMETER	TASK DESCRIPTION
1 1	G2	HYTSHT	H	D		HYDRAULIC TROUBLESHOOT
	H	MNHYRP		A	.60	HYDRAULIC MINOR REPAIR
	H	REMVH1	H1	FCLCKH1		REMOVE PART H1 FROM A/C
	H1	BCHKH1	J	D		BENCHCHECK H1
	J	TRANH1	J1	D		TRANSPORTATION TIME TO GET PART TO A/C
	J1	REPLH1		D		REPLACE H1 - A/C IS RELEASED
	J	INSPH1	J2	D		INSPECT H1 IN THE SHOP
	J2	REPRH1	J3	E	.70	REPAIR H1
	J3	DELH1		D		NORMAL SHOP DELAY
	J4	NRTSH1		E	.30	ORDER AND SHIPMENT TIME
	H	REMVH2	H2	FCLCKH2		REMOVE PART H2 FROM THE A/C
	H2	BCHKH2	K	D		BENCH CHECK PART H2
	K	TRANH2	K1	D		TRANSPORTATION TIME TO GET PART TO A/C
	K1	REPLH2		D		REPLACE H2 - A/C IS RELEASED
	K	INSPH2	K2	D		INSPECT H2 AT THE SHOP
	K2	REPRH2	K3	E	.90	REPAIR H2
	K3	DELH2		D		NORMAL SHOP DELAY
	K2	NRTSH2		E	.10	ORDER AND SHIP TIME
	G	CMDISP	G3	F		DISPATCH COMMUNICATIONS TECH TO A/C
	G3	CMTSHT	I	D		COMMUNICATIONS TROUBLESHOOT
	I	CMMNRP		A	.50	COMMUNICATIONS MINOR REPAIR
	I	REMVC1	I1	D		REMOVE PART C1 FROM A/C
	I1	BCHKC1	L	D		BENCH CHECK PART C1
	L	TRANC1	L1	D		TRANSPORTATION DELAY
	L1	REPLC1		D		REPLACE C1 - A/C IS RELEASED
	L	INSPC1	L2	D		INSPECT C1 IN THE SHOP
	L2	BKDNC1	M	D		BREAKDOWN PART C1
	M	RMVC11	N	FCLCK11		REMOVE SUB-ASSY C11 FROM C1
	N	DELC11	N1	D		NORMAL SHOP DELAY TIME
	N1	RPLC11		D		REASSEMBLE PART
	N	INSC11	N2	D		INSPECT SUBASSEMBLY C11
	N2	AWPC11	N3	E	.70	NORMAL SHOP WAIT TIME FOR PARTS
	N3	REPC11		D		REPAIR SUBASSEMBLY C11
	N2	NRTC11		E	.30	NORMAL ORDER AND SHIP TIME
V V	M	RMVC12	P	FCLCK12		REMOVE SUB-ASSY C12 FROM C1

SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = Do task, E = Either, F = Failure controlled, G = Get out, H = Halt, I = Ignore (cannib), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

FIGURE 9-5. SAMPLE PROBLEM 3.5's FORM 11 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SEL MODE	SELECTION PARAMETER	TASK DESCRIPTION
1 1	P	DELC12	P1	D		NORMAL SHOP DELAY TIME
	P1	RPLC12		D		REASSEMBLE PART
	P	INSC12	P2	D		INSPECT SUBASSEMBLY C12
	P2	AWPC12	P3	E	.85	NORMAL SHOP WAIT TIME FOR PARTS
	P3	REPC12		D		REPAIR PART C12
	P2	NRTC12		E	.15	NORMAL ORDER AND SHIP TIME
	C5	SORTIE	C55	S		SORTIE - CLSPT1
	C55	D	D1	C		CALL SECTION D FOR CLOCK DECREMENT
	C11	DFCAM		D		DECREMENT CAMERA CLOCK
	C6	SORTIE	C66	S		SORTIE - INTRD3
	C66	D	D2	C		CALL SECTION D FOR CLOCK DECREMENT
	C66	DFCAM		D		DECREMENT CAMERA CLOCK
	C7	SORTIE	C77	S		SORTIE - FERRY
	C77	D	D4	C		CALL SECTION D FOR CLOCK DECREMENT
	C44	DFCAM		D		DECREMENT CAMERA CLOCK
	C	FCAM	G4	F	CLKCAM	FAILED CAMERA
	G4	TCAM	G5	D		TEST CAMERA
	G5	RCAM	SUBCAM	E	.65	REMOVE CAMERA
	G5	MCAM	G6	E	.35	MINOR CAMERA REPAIR
	SUBCAM	CAMSHP		T		CAMERA SHOP REPAIR
	R1	INSTL	ADDCAM	D		INSTALL CAMERA
	ADDCAM	VCAM		T		VERIFY CAMERA OPERATION
	G6	VCAM		R		VERIFY CAMERA OPERATION W\ EXP PERS ONLY
	G6	VCAM2		R		VERIFY CAMERA OPERATION W\ INEXP HELPER

● SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = Do task, E = Either, F = Failure controlled, G = Get one, H = Halt, I = Ignore (cannib), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

FIGURE 9-5. SAMPLE PROBLEM 3.5's FORM 11 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 14 - FAILURE CLOCK DECREMENTS

CARD I.D.	TASK I.D.	MODE	RESOURCE I.D.	DECREMENT
14	SORTIE	S	CLCKH1	
			CLCKH2	
	DCRMNT	C	CLCK11	1
			CLCK12	1
	DCMCAA	C	CLCKAA	1
	DECBMS	C	CLKBMS	1
	DECSMT	C	CLKSMT	1
	DECMIS	C	CLKMIS	1
	DFCAM	C	CLKCAM	1
	DCSMT2	C	CK2SMT	1
	DCMIS2	C	CK2MIS	1

HEADER CARD NOT INCLUDED

MODE: S = Task length, C = Constant

FIGURE 9-6. SAMPLE PROBLEM 3.5's FORM 14

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 15 - DISTRIBUTIONS

CARD I.D.	DISTN I.D.	TYPE	FORMAT	1 PROB	1 VALUE	2 PROB	2 VALUE	3 PROB	3 VALUE	4 PROB	4 VALUE	5 PROB	5 VALUE	MULT
15	444	I	H	0.0	7.5	.05	3.25	.10	2.55	.15	2.15	.20	1.85	20
				.25	1.65	.30	1.45	.35	1.25	.40	1.17	.45	1.05	
				.50	.94	.55	.85	.60	.76	.65	.68	.70	.61	
				.75	.54	.80	.47	.85	.41	.90	.36	.95	.30	
				1.0	.25									
	777	S	M	0.0	0.0	.06	13.0	.14	15.0	.23	20.0	.35	26.0	
				.45	29.0	.50	30.0	.54	29.0	.60	28.0	.67	26.0	
				.74	22.0	.82	19.0	.87	16.0	.93	13.0	.95	11.0	
				.98	7.0	1.0	2.0							

HEADER CARD NOT INCLUDED

TYPE: I = Interpolate
S = Step Function

FIGURE 9-7. SAMPLE PROBLEM 3.5's FORM 15

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 16 - SHIFT CHANGE POLICIES

CARD I.D.	CODE ●	REPL NO. ◒	RESOURCE I.D.	SHIFT DURATIONS/AUTHORIZATIONS 1	2	3	4	5	6	7	8	9	10	11	12	13	14
16	*			2	8	8		HEADER CARD NOT INCLUDED									
	R					7											
			CREWCH	18	6	2											
			OMPERS	30	30	32											
			HYDTEC	4	15	6											
			HYDSPL	4	10	6											
			COMTEC	4	10	6											
			COMSPL	4	10	6											
			FLTENG	4	10	6											
			CENTEC	0	0	0											
	*		SH	9	8	7											
	R																
			MUNSPL	36	12	8											
			CAMTEC	4	4	2											

● CODE: * = New Policy, R = Repeat

◒ Repetition number - zero or blank thru 9.

FIGURE 9-8. SAMPLE PROBLEM 3.5's FORM 16

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 17 - MISSION/ACTIVITY ENTRY POINTS

CARD I.D.	MISSION I.D. OR ACTIVITY I.D.	REPORT COLUMN	NETWORK ENTRY POINT NODE	PRE-SORTIE EXTERNAL CONFIGURATION	POST-SORTIE EXTERNAL CONFIGURATION	AIRCRAFT ASSIGNMENT SEARCH PATTERN	AIRCRAFT NAME
17							
	PREFLT	AC	A			F4D	F4D
	RECON	1	B6	RECPOD	RECPOD	RECON6	F4D
	INTRD1	2	B3	BMS500	RACKS	RECON2	F4D
	CLSPT1	3	B1	BMS500	RACKS	RECON5	F4D
	CLSPT2	4	B2	SMTBMS	RACKS	RECON4	F4D
	INTRD2	5	B4	MISSLS	RACKS	RECON3	F4D
	INTRD3	6	B5	SMTBMS	RACKS	RECON7	F4D
	FERRY1	7	B7	CLEAN	CLEAN	RECON1	F4D
	FERRY2	8	B7	CLEAN	CLEAN		F4D.1

FIGURE 9-9. SAMPLE PROBLEM 3.5's FORM 17

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 21 - AIRCRAFT ASSIGNMENT SEARCH PATTERNS

CARD I.D.	AIRCRAFT ASSIGNMENT SEARCH PATTERN	CONT NOT	*	EXTERNAL CONFIGURATION NAME	EXTERNAL RECONFIGURATION ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIGURATION ENTRY NODE	CUT-OFF TIME (HOURS)	SP. SKIP	*	EXTERNAL CONFIGURATION NAME	EXTERNAL RECONFIGURATION ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIGURATION ENTRY NODE	CUT-OFF TIME (HOURS)	SP. SKIP
01 02 03	04 05 06 07 08 09 10	11	12	13 14 15 16 17 18	19 20 21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41	42	43	44 45 46 47 48 49	50 51 52 53 54 55	56 57 58 59 60 61	62 63 64 65 66 67	68 69 70 71 72	73
21	F4D	C	C	CLEAN				0.0			ACLEAN				0.0	
		C	A	RACKS				0.0			ARECPOD				0.0	
		C	M	ISSLS				0.0			CSMTBMS				0.0	
		C	B	MS500				0.0			CRECPOD				0.0	
	RECON6	C	R	ECPOD		1CAM		0.0			ARECPOD		1CAM		0.3	
		C	A	RECPOD		ØCAM	R1	1.0			ARACKS	Q13	1CAM		1.3	
		C	A	RACKS	Q13	ØCAM	R1	2.5			ACLEAN	Q11A	1CAM		1.8	
		C	A	CLEAN	Q11A	ØCAM	R1	2.5			CCLEAN	Q11A	1CAM		1.8	
		C	C	CLEAN	Q11A	ØCAM	R1	2.5			CMISSLS	Q11D	1CAM		2.3	
		C	C	MISSLS	Q11D	ØCAM	R1	3.0			CSMTBMS	Q11C	1CAM		2.3	
		C	C	SMTBMS	Q11C	ØCAM	R1	3.0			CBMS500	Q11B	1CAM		2.5	
		C	C	BMS500	Q11B	ØCAM	R1	3.2								
	RECON2	C	B	MS500		1CAM		0.0	X		CBMS500		ØCAM	R1	1.0	X
		C	A	RACKS	Q5	1CAM		1.2			ARACKS	Q5	ØCAM	R1	2.6	
		C	A	CLEAN	Q3A	1CAM		1.8	X		CCLEAN	Q3A	ØCAM	R1	2.5	X
		C	A	RECPOD	Q3E	1CAM		1.9	X		ARECPOD	Q3E	ØCAM	R1	2.6	X
		C	C	CLEAN	Q3A	1CAM		1.8	X		CCLEAN	Q3A	ØCAM	R1	2.5	X
		C	C	RECPOD	Q3E	1CAM		1.7	X		CSMTBMS	Q3C	1CAM		2.3	
		C	C	SMTBMS	Q3C	ØCAM	R1	3.0			CMISSLS	Q3D	1CAM		2.3	X
		C	C	MISSLS	Q3D	ØCAM	R1	3.0	X							
	RECON3	C	M	ISSLS				0.0			ARACKS	Q7			1.6	
		C	A	CLEAN	Q5A			1.9			ARECPOD	Q5E			1.8	X
		C	C	CLEAN	Q5A			1.9			CRECPOD	Q5E			1.8	X
		C	C	SMTBMS	Q5D			2.3			CBMS500	Q5C			2.6	
	RECON1	C	C	CLEAN				0.0			ACLEAN				0.3	
		C	A	RACKS	Q4A			0.6			ARECPOD	Q1E			1.0	
		C	C	RECPOD	Q1E			1.0			CMISSLS	Q1D			1.6	
		C	C	SMTBMS	Q1C			1.6			CBMS500	Q1B			1.8	
	RECON4	C	C	SMTBMS				0.0			ARACKS	Q9			1.5	
		C	A	CLEAN	Q7A			2.0			ARECPOD	Q7E			1.9	
		C	C	CLEAN	Q7A			2.0			CRECPOD	Q7E			1.9	
		C	C	MISSLS	Q7D			2.4			CBMS500	Q7C			2.7	

* "C" for checked aircraft or "A" for available aircraft

FIGURE 9-10. SAMPLE PROBLEM 3.5's FORM 21

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 21 - AIRCRAFT ASSIGNMENT SEARCH PATTERNS

CARD I.D.	AIRCRAFT ASSIGNMENT SEARCH PATTERN	CONT "C"	EXTERNAL •	EXTERNAL	INTERNAL	INTERNAL	CUT-OFF TIME (HOURS)	SP. SKIP	EXTERNAL •	EXTERNAL	INTERNAL	INTERNAL	CUT-OFF TIME (HOURS)	SP. SKIP
			CONFIGURATION NAME	RECONFIGURATION ENTRY NODE	EQUIPMENT GROUP	RECONFIGURATION ENTRY NODE			CONFIGURATION NAME	RECONFIGURATION ENTRY NODE	EQUIPMENT GROUP	RECONFIGURATION ENTRY NODE		
21	RECON5	C	BMS	500			0.0		ARACKS	Q5			1.3	
		C	ACLEAN	Q3A			1.8		CCLEAN	Q3A			1.8	
		C	ARECPOD	Q3E			2.2		CRECPOD	Q3E			2.2	
		C	CSMTBMS	Q3C			2.8		CMISSLS	Q3D			2.8	
	RECON7	C	CSMTBMS		1CAM		0.0		CSMTBMS		ØCAM	R1	1.0	
		C	ARACKS	Q9	1CAM		1.5		ARACKS	Q9	ØCAM	R1	1.2	
		C	ACLEAN	Q7A	1CAM		2.0		CCLEAN	Q7A	1CAM		2.0	
		C	ACLEAN	Q7A	ØCAM	R1	2.7		CCLEAN	Q7A	ØCAM	R1	2.7	

FIGURE 9-10. SAMPLE PROBLEM 3.5's FORM 21 (CONT'D)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 22 - INTERNAL EQUIPMENT AUTHORIZATIONS/CHANGES

CARD I.D.	AIRCRAFT NAME	CONT "C"	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY	INTERNAL EQUIPMENT TRIGGER NODE	INTERNAL EQUIPMENT EQUIPMENT NAME	•	INTERNAL EQUIPMENT AUTHORIZED QUANTITY
22	F4D		ADDCAMCAMERA	+		1	SUBCAMCAMERA	-						

*Trigger Status (+ or -)

FIGURE 9-11. SAMPLE PROBLEM 3.5's FORM 22

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 23 - INTERNAL EQUIPMENT GROUP DEFINITIONS

CARD I.D.	INTERNAL EQUIPMENT GROUP	CONT "C"	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL QUANTITY
23	1CAM		CAMERA	1								
	ØCAM		CAMERA	Ø								

FIGURE 9-12. SAMPLE PROBLEM 3.5's FORM 23

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 20 - SORTIE GENERATION DATA

CARD I.D.	DAY	NUMBER OF MISSIONS OR ACTIVITIES	TAKEOFF OR ACTIVITY TIME	AIRCRAFT I. D. OR RESOURCE I. D.	MISSION I. D. OR ACTIVITY I. D.	MISSION SIZE MIN	MISSION SIZE MAX ●	MISSION SIZE SPARE	MISSION LENGTH MEAN (OPTIM) ◒	MISSION LENGTH VARIANCE (LIKELY) ◒	MISSION LENGTH DIST	LEAD TIME ○	CANCEL TIME	PRIORITY	CYCLE INT	CYCLE STOP	TRIANGULAR DISTRIBUTION (PESSIM) ◒
20																	
1ST	60	3.5.8	SAMPLE PROBLEM 3.5		BASELINE EXOG												
	1	1	0300	F4D	PREFLT		99						3.5H	3		1999	
	1	1	0600	F4D	RECON	2	2	0	1+00		C	2.8H	.50K			1999	
	1	1	0700	F4D	INTRD3	1	1	0	1+00		C	2.8H	.75H			1999	
	1	1	0800	F4D	CLSPT2	3	4	0	1+30	+31	L	2.9H	.75H			1999	
	1	1	0830	F4D	INTRD1	2	2	1	1+00	+21	L	2.5H	.75H			1999	
	1	1	0900	F4D	RECON	2	2	0	1+00		C	2.8H	.50H			1999	
	1	1	1030	F4D	FERRY1	1	1	0	2+00	+41	L	2.5H	.75H	5		1999	
	1	1	1230	F4D	INTRD1	2	2	1	2+00	+41	L	2.5H	.75H			1999	
	1	1	1318	F4D	CLSPT1	2	3	0	+45	+11	L	3.0H	.55H			1999	
	1	1	1400	F4D	INTRD2	2	2	1	1+30	+31	L	2.6H	.75H			1999	
	1	1	1500	F4D	RECON	2	2	1	1+00		C	2.8H	.75H			1999	
	1	1	1600	F4D	RECON	1	1	0	+30		C	2.8H	.50H			1999	
	1	1	1800	F4D	RECON	1	1	0	+30		C	2.8H	.50H			1999	
	1	1	2000	F4D	RECON	1	1	0	+30		C	2.8H	.50H			1999	
	1	1	2200	F4D	RECON	1	1	0	+30		C	2.8H	.50H			1999	
	1	1	2400	F4D	FERRY2	2	2	0	2+00	+41	L	2.5H	.75H	5		1999	

◒ For triangular distribution use - input optimistic (optim), most likely (likely), and pessimistic (pessim) in columns indicated. Cannot be used with TACMOD feature or card sequence numbers.
● Max field is the only size field applicable to activities.
○ Must be zero or blank for activities.

FIGURE 9-13. SAMPLE PROBLEM 3.5's FORM 20

```
                                LCOMII  STANDARD  VERSION  HIS  RELEASE  3.5
SPEC CARD INFORMATION

      FORM = 10
      PRNT =  6
      EXOG =  9
      INIT =  7
      INFO =  3
```

FIGURE 9-14. SPEC CARD INFORMATION - SP3.5'S INPUT MODULE RUN

```
REPORT SPECIFICATIONS

 10  SAMPLE PROBLEM #3.5                                    HEADER CARD IGNORED
 1001   1D   7
 1003 RECON INTRD1CLSPT1CLSPT2INTRD2INTRD3FEPRY1FERRY2
 1005 F4D   F4D.1
 1007 CREWCHUMPERSFLTENGHYDIFCHYDSPLCOMTECCOMSPLMUNSPLCARTER
 1009 PUMPH1PUMPH2RDASSYRADC11RADC120MS500SMTBMSMISSLSCAMERA
 1011 TRUCK
 1013 SP3.5T
```

FIGURE 9-15. REPORT SPECIFICATIONS - SP3.5'S FORM 10 PROCESSING

RESOURCE DEFINITIONS

RESOURCE	TYPE	REP COL	UNIT COST	AUTH QTY	GENERAL SUBSTITUTE	FAILURE PARAMETERS MEAN	VARIANCE	DISTN TYPE	ADDITIONAL GENERAL SUBSTITUTES
13									HEADER CARD IGNORED
F4D	I	1	999999	18					
CREWCH	M	1	8000						
OMPERS	M	2	7500						
FLTENG	M	3	7500						
HYDTEC	M	4	7000		HYDSPL				
HYDSPL	M	5	6500		HYDTEC				
COMTEC	M	6	7600						
COMSPL	M	7	6500						
MUNSPL	M	8	6500						
TRUCK	A	1	6000	1					
PUMPH1	P	1	100	1					
PUMPH2	P	2	100	1					
RDASSY	P	3	1000	0					
RADC11	P	4	500	1					
RADC12	P	5	500	1					
BMS500	P	6	1000	800					
SMTBMS	P	7	18000	250					
MISSLS	P	8	14000	100					
CLCKH1	C					100H		C	
CLCKH2	C					.444			
CLCK11	C					50H	5H	X	
CLCK12	C					50H		C	
CLKBMS	C					8		C	
CK2BMS	C					8		C	
CLKSMT	C					4		C	
CK2SMT	C					4		C	
CLKMIS	C					4		C	
CK2MIS	C					4		C	
CLKCAM	C					5		C	
CAMTEC	M	9							
CAMERA	P	9	2600	3					
GENTEC	M	10	5000		COMTEC				HYDSPL CREWCH OMPERS
									**** MSG 41 REPORT COLUMN EXCEEDS NO OF HEADINGS - SET TO 10 ****
GENTEC					FLTENG				HYDTEC COMSPL MUNSPL
F4D.1	I	2	1KK	3					

FIGURE 9-16. RESOURCE DEFINITIONS - SP3.5'S FORM 13 PROCESSING

TASK RESOURCE REQUIREMENTS

TASK ID (T DIST.	TYP/PRI ONLY)-->		TASK DURATION MEAN (OPTIM.)	VARIANCE (LIKELY)	DISTN TYPE	IND TASK	ASSOC RES/ RES COMB SET	TASK RESOURCE REQUIREMENTS RES X/C QTY	RES X/C QTY	RES X/C QTY (PESSIM)
12								HEADER CARD IGNORED		
PREFLT	3	1	1.00H		C			CREWCH 1		
PRELCH	3	1	.30H	.03H	N			CREWCH 1		
SORTIE	1	1								
FUEL	3	1	.17H		C			OMPERS 2		
DCRMNT	5	1								
POSFLT	3	1	1.00H	0.1H	L			OMPERS 3		
POSFLT	A						FCT1 1	OMPERS 2	CREWCH 1	
POSFLT	A						FCT2 2	OMPERS 1	CREWCH 1	GENTEC X 1
HMODE1	5	1								
HMODE4	5	2								
DECBMS	5	1								
DCBMS2	5	2								
GENBMS	4	1				•	BMS500			
DELAY8	5	1	12D	1.2D	L	•				
HMODE2	5	1								
HMODE5	5	2								
DECSMT	5	1								
DCSMT2	5	2								
DELAYS	5	1	12D	1.2D	L	•				
GENSMT	4	1				•	SMTBMS			
HMODE3	5	1								
HMODE6	5	2								
DECMIS	5	1								
DCMIS2	5	2								
DELAYM	5	1	12D	1.2D	L	•				
GENMIS	4	1				•	MISSLS			
TSHOOT	2	1	(15)	(30)	T			FLTENG 1		(45M)
MNKEP1	2	1	*777					FLTENG 1		
HYDISP	2	1	15M	5M	N			HYDTEC 2		
HYDISP	A						FCT4 1	HYDTEC 1	HYDSPL 1	
HYDISP	A							HYDTEC X 1	GENTEC X 1	
								**** MSG 144 TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****		
HYTSHT	2	1	45M		C			HYDTEC 2		
HYTSHT	A						FCT4			
								**** MSG 144 TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****		
REDBAL	2	1	.25H		C					
MNHYRP	2	1	1H	30M	N			HYDSPL X 2		
REMVH1	2	1	30M	3M	L			HYDSPL X 1		
BCHKH1	2	1	30M	3M	L			HYDSPL X 1		
TRANH1	2	1	10M	5M	N			HYDSPL X 1	TPUCK 1	
REPLH1	2	1	30M	3M	L			PUMPH1 C 1	HYDSPL X 1	
INSPH1	2	2	15M	5M	N	•	PUMPH1	HYDSPL 1		
REPRH1	7	2	45M	5M	L			HYDSPL 1		
DELH1	2	2	1D	12H	N					
NRTSH1	4	2	20D	6D	N					
REMVH2	2	1	30M	10M	L			HYDSPL X 1		
BCHKH2	2	1	30M	10M	L			HYDSPL X 1		
TRANH2	2	1	10M	5M	L			HYDSPL X 1	TPUCK 1	

FIGURE 9-17. TASK RESOURCE REQUIREMENTS - SP 3.5'S FORM 12 PROCESSING

```
REPLH2       2  1       30M      10M     L                          PUMPH2 C  1     HYDSPL X  1
INSPH2       2  2       15M       2M     L     *    PUMPH2          HYDSPL    1
REPRH2       7  2       45M       5M     L                          HYDSPL    1
DELH2        2  2       2D       12H     N
NRTSH2       4  2       20D       6D      N
CMDISP       2  1       15M       5M      N                         COMTEC    1
CMTSHT       2  1       45M      15M      N                         COMTEC    2
CMMNRP       2  1        1H      30M      N                         COMTEC    2
CMMNRP  A                                          FCT3  1         COMTEC    1     GENTEC X  1
REMVC1       2  1       30M       3M      L                         COMTEC    2
REMVC1  A                                          FCT3  1
BCHKC1       2  1        1H      15M      N                         COMTEC    1
TRANC1       2  1       10M       5M      N                         OMPERS    1     TRUCK     1
REPLC1       2  1       30M       3M      L                         RDASSY C  1     COMSPL    1
INSPC1       2  2       15M      1.5M     L     *    RDASSY         COMSPL    1
BKDNC1       7  2       30M       3M      L                         COMSPL    1
RMVC11       2  2       30M       3M      L                         COMSPL    1
DELC11       2  2       10M       5M      N                         COMSPL    1
RPLC11       2  2       30M      10M      N                         COMSPL    1     RADC11 C  1
INSC11       2  2       15M      1.5M     L     *    RADC11         COMSPL    1
AWPC11       7  2       45M      15M      N                         COMSPL    1
REPC11       2  2       45M      4.5M     L                         COMSPL    1
NRTC11       4  2       20D       6D      N
RMVC12       2  2       30M       3M      L                         COMSPL    1
DELC12       2  2       10M       5M      N                         COMSPL    1
RPLC12       2  2       30M       3M      L                         COMSPL    1     RADC12 C  1
INSC12       2  2       15M      1.5M     L     *    RADC12         COMSPL    1
AWPC12       7  2       45M      4.5M     L                         COMSPL    1
REPC12       2  2       45M      4.5M     L                         COMSPL    1
NRTC12       4  2       20D       6D      N
DL.BMS       2  1     1.20H      .12H     L                         MUNSPL    4
RPLBMS       7  2                                 *    BMS500
TRNBMS       2  2      0.5H                C     *                   TRUCK     1     MUNSPL    1
TRNBMS  A                                                          GENTEC X  1
                                                          **** MSG 144  TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****
DL.MIS       2  1     1.00H      .10H     L                         MUNSPL    4
RPLMIS       7  2                                 *    MISSLS
TRNMIS       2  2      0.5H                C     *                   TRUCK     1     MUNSPL    1
TRNMIS  A                                                          GENTEC X  1
                                                          **** MSG 144  TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****
DL.SMT       2  1     1.00H      .10H     L                         MUNSPL    4
RPLSMT       7  2                                 *    SMTBMS
TRNSMT       2  2      0.5H                C     *                   TRUCK     1     MUNSPL    1
TRNSMT  A                                                          GENTEC X  1
                                                          **** MSG 144  TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****
DL.POD       2  1       .40H      .04H     L                         MUNSPL    4
DL.RCK       2  1       .30H      .03H     L                         CREWCH    2
UL.RCK       2  1       .50H      .05H     L                         CREWCH    2
UL.BMS       2  1     1.00H      .10H     L                         MUNSPL    4     BMS500 C  8
UL.MIS       2  1     1.10H      .11H     L                         MUNSPL    4     MISSLS C  4
UL.SMT       2  1     1.20H      .12H     L                         MUNSPL    4     SMTBMS C  4
UL.POD       2  1     1.00H      .10H     L                         MUNSPL    4
FCAM         2  1       %.0H                C
TCAM         2  1       0.6H      .06H     L                         CAMTEC    1
RCAM         2  1       0.3H      .03H     L                         CAMTEC    2
```

FIGURE 9-17. TASK RESOURCE REQUIREMENTS - SP3.5'S FORM 12 PROCESSING (CONT'D)

```
CAMSHF      7  2      1.5H     .15H    L        *   CAMERA        CAMTEC   1
MCAM        2  1      0.2H     .02H    L            CAMTEC   1
VCAM        2  1      0.2H     .02H    L            CAMTEC   2
VCAM2       2  2      0.4H     .04H    L            CAMTEC   1     OMPERS     1
INSTL       2  1      0.5H     .05H    L            CAMTEC   2     CAMERA C   1
DFCAM       5  1      0.0H             C
THRFLT      3  1      .5H      .05H    L            OMPERS   3
THRFLT  A                                  FCT1
                                           **** MSG 144  TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****
THRFLT  A                                  FCT2
                                           **** MSG 144  TASK SUBSTITUTION NUMBER BLANK - TREATED AS ZERO ****
```

FIGURE 9-17. TASK RESOURCE REQUIREMENTS - SP3.5'S FORM 12 PROCESSING (CONT'D)

```
**** MSG 140                                  **** THE FOLLOWING TASKS HAVE MULTIPLY DEFINED RESOURCES ****
 TASK      CIRC     ORIG     ORIG
           RES      RES 1    RES 2

 PUSFLT    CREWCH   GENTEC
 POSFLT    OMPERS   GENTEC
 HYDISP    HYDTEC   GENTEC
 HYDISP    HYDSPL   GENTEC   HYDTEC
 CMMNRP    COMTEC   GENTEC
 REMVC1    COMTEC   GENTEC
 THRFLT    CREWCH   GENTEC
 THRFLT    OMPERS   GENTEC
```

FIGURE 9-17. PART 2. MESSAGE 140 - CIRCULAR SUBSTITUTION

TASK NETWORK - INPUT DATA

INDEX	NODE	SEL MODE	TASK ID	NEXT	SEL PARAM	TASK DESCRIPTION
11						HEADER CARD IGNORED
1	A	J	PREFLT			PRE-FLIGHT
2	B1	C	F	C5		CALL SECTION F FOR PREFLT AND PRELCH
3	F	J	PREFLT	F1		PRE-FLIGHT IF NOT PREVIOUSLY DONE
4	F1	K		F2		K SELECTION MODE
5	F2	D	PRELCH			PRE-LAUNCH
6	F2	A	REDBAL		.0073	REDBALL UNSCHEDULED MAINTENANCE
7	C1	S	SORTIE	C11		SORTIE - INTRD1
8	C11	C	D	D1		CALL SECTION D FOR CLOCK DECREMENT
9	ORDBMS	D	DELAYB	D1BA		DELAY TASK TO SIMULATE DELIVERY TIME
10	D1BA	H	HMODE1	D1BB	CLKBMS	H SELECTION MODE - HALTS WHEN CLKBMS EQ 0
11	D1BB	D	DECBMS	D1BC		DECREMENT CLKBMS
12	D1BC	D		D1BA		LOOP
13	D1BC	D	GENBMS			GENERATES ONE BOMB ON EACH LOOP
14	D1	C	E	G		CALL SECTION E FOR FUEL AND POSFLT
15	D1	C	ORDBMS			CALL ORDBMS TO GENERATE 8 BOMBS
16	E	D	FUEL	E1		REFUEL AIRCRAFT
17	E1	D	POSFLT			POST-FLIGHT AIRCRAFT
18	D	D	DCRMNT			DECREMENT CLOCKS
19	B2	C	F	C2		CALL SECTION F FOR PREFLT AND PRELCH
20	C2	S	SORTIE	C22		SORTIE - CLSPT2
21	C22	C	D	D2		CALL SECTION D FOR CLOCK DECREMENT
22	ORDSMT	D	DELAYS	D2BA		DELAY TASK TO SIMULATE DELIVERY TIME
23	D2BA	H	HMODE2	D2BB	CLKSMT	H SELECTION MODE -HALTS WHEN CLKSMT EQ 0
24	D2BB	D	DECSMT	D2BC		DECREMENT CLKSMT
25	D2BC	D		D2BA		LOOP
26	D2BC	D	GENSMT			GENERATES ONE SMTBM ON EACH LOOP
27	D2	C	E	G		CALL SECTION E FOR FUEL AND POSFLT
28	D2	C	ORDSMT			CALL ORDSMT TO GENERATE 4 SMTBMS
29	B3	C	F	C1		CALL SECTION F (INTRD1 SORTIE/BMS500)
30	B4	C	F	C3		CALL SECTION F (INTRD2 SORTIE/MISSL3)
31	C3	S	SORTIE	C33		SORTIE -INTRD2
32	C33	C	D	D3		CALL SECTION D FOR CLOCK DECREMENT
33	ORDMIS	D	DELAYM	D3BA		DELAY TASK TO SIMULATE DELIVERY TIME
34	D3BA	H	HMODE3	D3BB	CLKMIS	H SELECTION MODE -HALTS WHEN CLKMIS EQ 0
35	D3BB	D	DECMIS	D3BC		DECREMENT CLKMIS
36	D3BC	D		D3BA		LOOP
37	D3BC	D	GENMIS			GENERATES ONE MISSILE ON EACH LOOP
38	D3	C	E	G		CALL SECTION E FOR FUEL AND POSFLT
39	D3	C	ORDMIS			CALL ORDMIS TO GENERATE 4 MISSLS
40	B6	C	F	C4		CALL SECTION F (RECON SORTIE)
41	C4	S	SORTIE	C44		SORTIE -RECON
42	C44	C	D	D4		CALL SECTION D FOR CLOCK DECREMENT
43	D4	C	E	G		CALL SECTION E FOR FUEL AND POSFLT
44	B7	C	F	C7		CALL SECTION F (FERRY SORTIE)
45	B5	C	F	C6		CALL SECTION F (INTRD3 SORTIE/SMTBMS)
46	RS.BMS	D		RB1		CONNECTING LINK - RESTOCK BMS500
47	RS.BMS	D	TRNBMS			TRANSPORTS BMS500 TO DUMP
48	RB1	H	HMODE4	RB2	CK2BMS	H SELECTION MODE - HALTS WHEN CK2BMS=0
49	RB2	D	DCRMS2	RB3		DECREMENT CK2BMS

FIGURE 9-18. TASK NETWORK INPUT DATA - SP3.5'S FORM 11 PROCESSING

```
 50      RB3   U                RB1                INITIATES NEXT LOOP
 51      RB3   U   RPLBMS                         GENERATES ONE BMS500 ON EACH LOOP
 52   RS.SMT   U                RS1                CONNECTING LINK - RESTOCK SMTBMS
 53   RS.SMT   D   TRNSMT                         TRANSPORTS SMTBMS TO DUMP
 54      RS1   H   HMODE5       RS2   CK2SMT      H SELECTION MODE - HALTS WHEN CK2SMT=0
 55      RS2   U   DCSMT2       RS3                DECREMENT CK2SMT
 56      RS3   U                RS1                INITIATES NEXT LOOP
 57      RS3   U   RPLSMT                          GENERATES ONE SMTBMS ON EACH LOOP
 58   RS.MIS   D                RM1                CONNECTING LINK - RESTOCK MISSLS
 59   RS.MIS   D   TRNMIS                         TRANSPORTS MISSLS TO DUMP
 60      RM1   H   HMODE6       RM2   CK2MIS      H SELECTION MODE - HALTS WHEN CK2MIS=0
 61      RM2   U   DCMIS2       RM3                DECREMENT CK2MIS
 62      RM3   D                RM1                INITIATES NEXT LOOP
 63      RM3   D   RPLMIS                          GENERATES ONE MISSLS ON EACH LOOP
 64      Q1B   D   DL.BMS        Q2B                DOWN LOAD BMS500
 65      Q1D   D   DL.MIS        Q2D                DOWN LOAD MISSLS
 66      Q1C   D   DL.SMT        Q2C                DOWN LOAD SMTBMS
 67      Q1E   D   DL.POD        Q3                 DOWN LOAD RECPOD
 68       Q3   D   DL.RCK                           DOWN LOAD RACKS
 69      Q2B   C   RS.BMS        Q3                 RESTOCK 8 BMS500
 70      Q2D   C   RS.MIS        Q3                 RESTOCK 4 MISSLS
 71      Q2C   C   RS.SMT        Q3                 RESTOCK 4 SMTBMS
 72      Q3A   D   UL.RCK        Q5                 UPLOAD RACKS
 73      Q3D   D   DL.MIS        Q4D                DOWN LOAD MISSLS
 74      Q3C   D   DL.SMT        Q4C                DOWN LOAD SMTBMS
 75      Q3E   D   DL.POD        Q5                 DOWN LOAD RECPOD
 76       Q5   D   UL.BMS                           UPLOAD BMS500
 77      Q4A   D   DL.RCK                           DOWN LOAD RACKS(FOR A/C W/ RACKS ONLY)
 78      Q4C   C   RS.SMT        Q5                 RESTOCK 4 SMTBMS
 79      Q4D   C   RS.MIS        Q5                 RESTOCK 4 MISSLS
 80      Q5A   D   UL.RCK        Q7                 UPLOAD RACKS
 81      Q5C   D   DL.BMS        Q6C                DOWN LOAD BMS500
 82      Q5D   D   DL.SMT        Q6D                DOWN LOAD SMTBMS
 83      Q5E   D   DL.POD        Q7                 DOWN LOAD RECPOD
 84       Q7   D   UL.MIS                           UPLOAD MISSLS
 85      Q6C   C   RS.BMS        Q7                 RESTOCK 8 BMS500
 86      Q6D   C   RS.SMT        Q7                 RESTOCK 4 SMTBMS
 87      Q7A   D   UL.RCK        Q9                 UPLOAD RACKS
 88      Q7C   D   DL.BMS        Q8C                DOWN LOAD BMS500
 89      Q7D   D   DL.MIS        Q8D                DOWN LOAD MISSLS
 90      Q7E   D   DL.POD        Q9                 DOWN LOAD RECPOD
 91       Q9   D   UL.SMT                           UPLOAD SMTBMS
 92      Q8C   C   RS.BMS        Q9                 RESTOCK 8 BMS500
 93      Q8D   C   RS.MIS        Q9                 RESTOCK 4 MISSLS
 94     Q11A   D   UL.RCK       Q13                 UPLOAD RACKS
 95     Q11B   D   DL.BMS      Q12B                 DOWN LOAD BMS500
 96     Q11D   D   DL.MIS      Q12D                 DOWN LOAD MISSLS
 97     Q11C   D   DL.SMT      Q12C                 DOWN LOAD SMTBMS
 98      Q13   D   UL.POD                           UPLOAD RECPOD
 99     Q12B   C   RS.BMS       Q13                 RESTOCK 8 BMS500
100     Q12C   C   RS.SMT       Q13                 RESTOCK 4 SMTBMS
101     Q12D   C   RS.MIS       Q13                 RESTOCK 4 MISSLS
102        G   A   TSHOOT        G1      .40        HYDRAULIC TROUBLESHOOT
103       G1   D   MNREP1                           MINOR REPAIR
104        G   F   HYDISP        G2                 HYDRAULIC DISPATCH
```

FIGURE 9-18. TASK NETWORK INPUT DATA - SP3.5'S FORM 11 PROCESSING (CONT'D)

105	G2	D	HYISHT	H		HYDRAULIC TROUBLESHOOT
106	H	A	HMHYRP		.60	HYDRAULIC MINOR REPAIR
107	H	F	REMVH1	H1	CLCKH1	REMOVE PART H1 FROM A/C
108	H1	D	BCHKH1	J		BENCHCHECK H1
109	J	D	TRANH1	J1		TRANSPORTATION TIME TO GET PART TO A/C
110	J1	D	REPLH1			REPLACE H1 - A/C IS RELEASED
111	J	D	INSPH1	J2		INSPECT H1 IN THE SHOP
112	J2	E	REPRH1	J3	.70	REPAIR H1
113	J3	D	DELH1			NORMAL SHOP DELAY
114	J2	E	NRTSH1		.30	ORDER AND SHIPMENT TIME
115	H	F	REMVH2	H2	CLCKH2	REMOVE PART H2 FROM THE A/C
116	H2	D	BCHKH2	K		BENCH CHECK PART H2
117	K	D	TRANH2	K1		TRANSPORTATION TIME TO GET PART TO A/C
118	K1	I	REPLH2			REPLACE H2 - A/C IS RELEASED
119	K	D	INSPH2	K2		INSPECT H2 AT THE SHOP
120	K2	E	REPRH2	K3	.90	REPAIR H2
121	K3	D	DELH2			NORMAL SHOP DELAY
122	K2	E	NRTSH2		.10	ORDER AND SHIP TIME
123	G	F	CMDISP	G3		DISPATCH COMMUNICATIONS TECH TO A/C
124	G3	D	CMTSHT	I		COMMUNICATIONS TROUBLESHOOT
125	I	A	CMMNRP		.50	COMMUNICATIONS MINOR REPAIR
126	I	D	REMVC1	I1		REMOVE PART C1 FROM A/C
127	I1	D	BCHKC1	L		BENCH CHECK PART C1
128	L	D	TRANC1	L1		TRANSPORTATION DELAY
129	L1	I	REPLC1			REPLACE C1 - A/C IS RELEASED
130	L	D	INSPC1	L2		INSPECT C1 IN THE SHOP
131	L2	D	BKDNC1	M		BREAKDOWN PART C1
132	M	F	REMVC11	N	CLCK11	REMOVE SUB-ASSY C11 FROM C1
133	N	D	DELC11	.1		NORMAL SHOP DELAY TIME
134	N1	D	RPLC11			REASSEMBLE PART
135	N	D	INSC11	N2		INSPECT SUBASSEMBLY C11
136	N2	E	AWPC11	N3	.70	NORMAL SHOP WAIT TIME FOR PARTS
137	N3	D	REPC11			REPAIR SUBASSEMBLY C11
138	N2	E	NRTC11		.30	NORMAL ORDER AND SHIP TIME
139	M	F	RMVC12	P	CLCK12	REMOVE SUB-ASSY C12 FROM C1
140	P	D	DELC12	P1		NORMAL SHOP DELAY TIME
141	P1	D	RPLC12			REASSEMBLE PART
142	P	D	INSC12	P2		INSPECT SUBASSEMBLY C12
143	P2	E	AWPC12	P3	.85	NORMAL SHOP WAIT TIME FOR PARTS
144	P3	D	REPC12			REPAIR PART C12
145	P2	E	NRTC12		.15	NORMAL ORDER AND SHIP TIME
146	C5	S	SORTIE	C55		SORTIE - CLSPT1
147	C55	C	D	D1		CALL SECTION D FOR CLOCK DECREMENT
148	C11	D	DFCAM			DECREMENT CAMERA CLOCK
149	C6	S	SORTIE	C66		SORTIE - INTRD3
150	C66	C	D	D2		CALL SECTION D FOR CLOCK DECREMENT
151	C66	D	DFCAM			DECREMENT CAMERA CLOCK
152	C7	S	SORTIE	C77		SORTIE - FERRY
153	C77	C	D	D4		CALL SECTION D FOR CLOCK DECREMENT
154	C44	D	DFCAM			DECREMENT CAMERA CLOCK
155	G	F	FCAM	G4	CLKCAM	FAILED CAMERA
156	G4	D	TCAM	G5		TEST CAMERA
157	G5	E	RCAM	SUBCAM	.65	REMOVE CAMERA
158	G5	F	MCAM	G6	.35	MINOR CAMERA REPAIR
159	SUBCAM	T	CAMSHP			CAMERA SHOP REPAIR
160	K1	D	INSTL	ADDCAM		INSTALL CAMERA
161	ADDCAM	T	VCAM			VERIFY CAMERA OPERATION
162	G6	K	VCAM			VERIFY CAMERA OPERATION W/ EXP PERS ONLY
163	G6	F	VCAM2			VERIFY CAMERA OPERATION W/ INEXP HELPER

FIGURE 9-18. TASK NETWORK INPUT DATA - SP3.5'S FORM 11 PROCESSING (CONT'D)

```
RESOURCE CLOCK DECREMENTS

DECREMENTING
   TASK        MODE     RESOURCE    DECREMENT

 14                                                    HEADER CARD IGNORED
  SORTIE         S        CLCKH1
                          CLCKH2
  DCRMNT         C        CLCK11          1
                          CLCK12          1
                                                **** MSG  20 REDEFINITION OF CLOCK DECREMENT IGNORED ****
  DECHMS         C        CLKHMS          1
  DECSMT         C        CLKSMT          1
  DECMIS         C        CLKMIS          1
  DFCAM          C        CLKCAM          1
  DC8MS2         C        CK2HMS          1
  DCSMT2         C        CK2SMT          1
  DCMIS2         C        CK2MIS          1
```

FIGURE 9-19. RESOURCE CLOCK DECREMENTS - SP3.5'S FORM 14 PROCESSING

DISTRIBUTIONS

NO.	TYPE	PROB	VALUE	PROB	VALUE	PROB	VALUE	PROB	VALUE	PROB	VALUE	MULTIPLIER
15								HEADER CARD IGNORED				
444	I M	0.0	7.5	.05	3.25	.10	2.55	.15	2.15	.20	1.85	20
		.25	1.65	.30	1.45	.35	1.25	.40	1.17	.45	1.05	
		.50	.94	.55	.85	.60	.76	.65	.68	.70	.61	
		.75	.54	.80	.47	.85	.41	.90	.36	.95	.30	
		1.0	.25									
777	S M	0.0	0.0	.06	13.0	.14	15.0	.23	20.0	.35	26.0	
		.45	29.0	.53	30.0	.54	29.0	.60	28.0	.67	26.0	
		.74	22.0	.82	19.0	.87	16.0	.93	13.0	.95	11.0	
		.98	7.0	1.0	2.0							

DISTRIBUTION NO. 444

0.	6.250000
.050000	2.708333
.100000	2.125000
.150000	1.791667
.200000	1.541667
.250000	1.375000
.300000	1.208333
.350000	1.041667
.400000	.975000
.450000	.875000
.500000	.783333
.550000	.708333
.600000	.633333
.650000	.566667
.700000	.508333
.750000	.450000
.800000	.391667
.850000	.341667
.900000	.300000
.950000	.250000
1.000000	.208333

DISTRIBUTION NO. 777

0.	0.
.060000	.009028
.140000	.010417
.230000	.013889
.350000	.018056
.450000	.020139
.500000	.020833
.540000	.020139
.600000	.019444
.670000	.018056
.740000	.015278
.820000	.013194
.870000	.011111
.930000	.009028
.950000	.007639
.980000	.004861
1.000000	.001389

FIGURE 9-20. EMPIRICAL DISTRIBUTIONS - SP3.5'S FORM 15 PROCESSING

SHIFT POLICIES

RESOURCE	DURATION/AUTHORIZATION 1	2	3	4	5	6	7	8	9	10	11	12	13	14
16										HEADER CARD IGNORED				
*	8	8	8											
R			7											
CREWCH	18	6	2											
OMPERS	30	30	30											
HYDTEC	4	15	6											
HYDSPL	4	10	6											
COMTEC	4	10	6											
COMSPL	4	10	6											
FLTENG	4	10	6											
GENTEC	0	0	0											
* SH	9	8	7											
R														
MUNSPL	36	12	8											
CAMTEC	4	4	2											

FIGURE 9-21. SHIFT POLICIES - SP3.5'S FORM 16 PROCESSING

MISSION ENTRY POINTS - CONFIGURATIONS(CLASSES)

MSN/ACTY I.D.	MFT COL	METHOD ENTRY	PRE-SORTIE EXT CONF	POST-SORTIE EXT CONF	SEARCH PATTERN	AIRCRAFT NAME
17					HEADER CARD IGNORED	
PREFLT	AC	A			F4D	F4D
RECON	1	P6	RECPOD	RECPOD	RECON6	F4D
INTRP1	2	P3	RMS500	RACKS	RECON2	F4D
CLSPT1	3	P1	RMS500	RACKS	RECON5	F4D
CLSPT2	4	P2	SMTRMS	RACKS	RECON4	F4D
INTRP2	5	P4	MISSLS	RACKS	RECON3	F4D
INTRP3	6	P5	SMTRMS	RACKS	RECON7	F4D
FERRY1	7	P7	CLEAN	CLEAN	RECON1	F4D
FERRY2	8	P7	CLEAN	CLEAN	F4D.1	

**** MSG 67 NO SEARCH PATTERN NAME SPECIFIED - ASSUME SEARCH PATTERN WITH SAME NAME AS AIRCRAFT ****

FIGURE 9-22. MISSION ENTRY POINTS/CONFIGURATIONS SP3.5'S FORM 17 PROCESSING

AIRCRAFT ASSIGNMENT SEARCH PATTERNS

AC ASGMNT SEARCH PATTERN	AVAIL OR COCKED	EXTRNL CONFIG NAME	EXTERNAL RECONFIG ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIG ENTRY NODE	CUTOFF TIME (HRS)	SKIP IF SPARE	AVAIL OR COCKED	EXTRNL CONFIG NAME	EXTERNAL RECONFIG ENTRY NODE	INTERNAL EQUIPMENT GROUP	INTERNAL RECONFIG ENTRY NODE	CUTOFF TIME (HRS)	SKIP IF SPARE
21									HEADER CARD IGNORED					
F4D		C CLEAN				0.0		A CLEAN					0.0	
**** MSG 16 IN COLUMNS 5 TO 10									WARNING* REDEFINING DEFAULT SEARCH PATTERN MUST INCLUDE ALL CONFIGURATIONS AND STATUSES FOR THIS A/C, THE ORDER IS INSIGNIFICANT ****					
C	A	RACKS				0.0		A	RECPOD				0.0	
C	C	MISSLS				0.0		C	SMTBMS				0.0	
C	C	BMS500				0.0		C	RECPOD				0.0	
RECON6	C	RECPOD		1CAM		0.0		A	RECPOD		1CAM		0.3	
C	A	RECPOD		0CAM	R1	1.0		A	RACKS	Q13	1CAM		1.3	
C	A	RACKS	Q13	0CAM	R1	2.0		A	CLEAN	Q11A	1CAM		1.8	
C	A	CLEAN	Q11A	0CAM	R1	2.5		C	CLEAN	Q11A	1CAM		1.8	
C	C	CLEAN	Q11A	0CAM	R1	2.5		C	MISSLS	Q11D	1CAM		2.1	
C	C	MISSLS	Q11D	0CAM	R1	3.0		C	SMTBMS	Q11C	1CAM		2.3	
C	C	SMTBMS	Q11C	0CAM	R1	3.0		C	BMS500	Q11B	1CAM		2.5	
C	C	BMS500	Q11B	0CAM	R1	3.2								
RECON2	C	BMS500		1CAM		0.0	X	C	BMS500		0CAM	R1	1.8	X
C	A	RACKS	05	1CAM		1.9		A	RACKS	05	0CAM	R1	2.6	
C	A	CLEAN	Q3A	1CAM		1.8	X	A	CLEAN	Q3A	0CAM	R1	2.5	X
C	A	RECPOD	Q3E	1CAM		1.9	X	A	RECPOD	Q3E	0CAM	R1	2.6	X
C	C	CLEAN	Q3A	1CAM		1.8	X	C	CLEAN	Q3A	0CAM	R1	2.5	X
C	C	RECPOD	Q3E	1CAM		1.7	X	C	SMTBMS	Q3C	1CAM		2.3	
C	C	SMTBMS	Q3C	0CAM	R1	3.0		C	MISSLS	Q3D	1CAM		2.3	X
C	C	MISSLS	Q3D	0CAM	R1	3.0	X							
RECON3	C	MISSLS				0.0		A	RACKS	Q7			1.6	
C	A	CLEAN	Q5A			1.9		A	RECPOD	Q5E			1.8	X
C	C	CLEAN	Q5A			1.9		C	RECPOD	Q5E			1.8	X
C	C	SMTBMS	Q5D			2.3		C	BMS500	Q5C			2.6	
RECON1	C	CLEAN				0.0		A	CLEAN				0.3	
C	A	RACKS	Q4A			0.6		A	RECPOD	Q1E			1.0	
C	C	RECPOD	Q1E			1.0		C	MISSLS	Q1D			1.6	
C	C	SMTBMS	Q1C			1.6		C	BMS500	Q18			1.8	
RECON4	C	SMTBMS				0.0		A	RACKS	Q9			1.5	
C	A	CLEAN	Q7A			2.0		A	RECPOD	Q7E			1.7	
C	C	CLEAN	Q7A			2.0		C	RECPOD	Q7E			1.9	
C	C	MISSLS	Q7D			2.4		C	BMS500	Q7C			2.7	
RECON5	C	BMS500				0.0		A	RACKS	Q5			1.3	
C	A	CLEAN	Q3A			1.8		C	CLEAN	Q3A			1.8	
C	A	RECPOD	Q3E			2.2		C	RECPOD	Q3E			2.2	
C	C	SMTBMS	Q3C			2.8		C	MISSLS	Q3B			2.8	
RECON7	C	SMTBMS		1CAM		0.0		C	SMTBMS		0CAM	R1	1.0	
C	A	RACKS	Q9	1CAM		1.5		A	RACKS	Q9	0CAM	R1	1.2	
C	A	CLEAN	Q7A	1CAM		2.0		C	CLEAN	Q7A	1CAM		2.0	
C	A	CLEAN	Q7A	0CAM	R1	2.7		C	CLEAN	Q7A	0CAM	R1	2.7	
C	A	RECPOD	Q7E	1CAM		1.9		C	RECPOD	Q7E	1CAM		1.9	
C	A	RECPOD	Q7E	0CAM	R1	2.6		C	MISSLS	Q7D	1CAM		2.5	
C	C	BMS500	Q7C	1CAM		2.7		C	MISSLS	Q7D	0CAM	R1	3.2	
C	C	BMS500	Q7C	0CAM	R1	3.4								

FIGURE 9-23. AIRCRAFT ASSIGNMENT SEARCH PATTERNS - SP3.5'S FORM 21 PROCESSING

INTERNAL EQUIPMENT AUTHORIZATIONS/TRIGGER NODE CHANGES

AIRCRAFT NAME	TRIGGER NODE NAME	INTERNAL EQUIPMENT NAME	TRIGGER STATUS (+OR-)	AUTHORIZED QUANTITY	TRIGGER NODE NAME	INTERNAL EQUIPMENT NAME	TRIGGER STATUS (+OR-)	AUTHORIZED QUANTITY	TRIGGER NAME	INTERNAL EQUIPMENT	TRIGGER STATUS (+OR-)	AUTHORIZED QUANTITY
22								HEADER CARD IGNORED				
F4D	ADDCAM	CAMERA	+	1	SUBCAM	CAMERA	-					

FIGURE 9-24. INTERNAL EQUIPMENT AUTHORIZATION/TRIGGER NODE CHANGES - SP3.5'S FORM 22 PROCESSING

INTERNAL EQUIPMENT GROUP DEFINITIONS

INTERNAL EQUIPMENT GROUP	INTERNAL EQUIPMENT NAME	INTERNAL EQUIPMENT QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL EQUIPMENT QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL EQUIPMENT QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL EQUIPMENT QUANTITY	INTERNAL EQUIPMENT NAME	INTERNAL EQUIPMENT QUANTITY
23							HEADER CARD IGNORED			
1CAM	CAMERA	1								
8CAM	CAMERA	8								

FIGURE 9-25. INTERNAL EQUIPMENT GROUP DEFINITIONS - SP3.5'S FORM 23 PROCESSING

```
FORM 20 PROCESSING

 20                                                                    HEADER CARD IGNORED
 LIST 60 3.5.BL SAMPLE PROBLEM 3.5 BASELINE EXOG
BEGIN  0.0
EXOG DATA FILE GENERATED FOR  60. DAYS. IDENT = 3.5.BL SAMPLE PROBLEM 3.5 BASELINE EXOG
  20   1    1  0300 F4D    PREFLT   99                          3.5H  3    1999
  20   1    1  0600 F4D    RECON    2 2 0   1+00       C 2.8H .50H        1999
  20   1    1  0700 F4D    INTRD3   1 1 0   1+00       C 2.8H .75H        1999
  20   1    1  0800 F4D    CLSPT2   3 4 0   1+30   +31L 2.9H .75H        1999
  20   1    1  0830 F4D    INTRD1   2 2 1   1+00   +21L 2.5H .75H        1999
  20   1    1  1000 F4D    RECON    2 2 0   1+00       C 2.8H .50H        1999
  20   1    1  1030 F4D    FERRY1   1 1 0   2+00   +41L 2.5H .75H  5     1999
  20   1    1  1230 F4D    INTRD1   2 2 1   2+60   +41L 2.5H .75H        1999
  20   1    1  1318 F4D    CLSPT1   2 3 0     +45   +11L 3.0H .55H        1999
  20   1    1  1400 F4D    INTRD2   2 2 1   1+30   +31L 2.6H .75H        1999
  20   1    1  1500 F4D    RECON    2 2 1   1+00       C 2.8H .75H        1999
  20   1    1  1600 F4D    RECON    1 1 0     +30       C 2.8H .50H        1999
  20   1    1  1800 F4D    RECON    1 1 0     +30       C 2.8H .50H        1999
  20   1    1  1900 F4D    RECON    1 1 0     +30       C 2.8H .50H        1999
  20   1    1  2200 F4D    RECON    1 1 0     +30       C 2.8H .50H        1999
  20   1    1  2400 F4D.1  FERRY2   2 2 0   2+00   +41L 2.5H .75H  5     1999

                SECTION 1

DAY   1

TIME    MISSION  A/C TYPE   SCHED (MIN)(SPARE)  PRIORITY   TAKEOFF   LATENESS   SORTIE LENGTH   LEAD TIME

 300    PREFLT   F4D          99     0     0        3         300     0+ 3+30     0+ 0+ 0      0+ 0+ 0
 312    RECON    F4D           2     2     0        1         600     0+ 0+30     0+ 4+ 0      0+ 2+48
 412    INTRD3   F4D           1     1     0        1         700     0+ 0+45     0+ 1+ 0      0+ 2+48
 506    CLSPT2   F4D           4     3     0        1         800     0+ 0+45     0+ 1+50      0+ 2+54
 600    INTRD1   F4D           2     2     1        1         830     0+ 0+45     0+ 1+ 4      0+ 2+30
 712    RECON    F4D           2     2     0        1        1000     0+ 0+30     0+ 1+ 0      0+ 2+48
 800    FERRY1   F4D           1     1     0        5        1030     0+ 0+45     0+ 1+44      0+ 2+30
1000    INTRD1   F4D           2     2     1        1        1230     0+ 0+45     0+ 1+10      0+ 2+30
1012    CLSPT1   F4D           3     2     0        1        1318     0+ 0+33     0+ 0+37      0+ 3+ 0
1124    INTRD2   F4D           2     2     1        1        1400     0+ 0+45     0+ 1+19      0+ 2+36
1212    RECON    F4D           2     2     1        1        1500     0+ 0+45     0+ 1+ 0      0+ 2+48
1312    RECON    F4D           1     1     0        1        1600     0+ 0+30     0+ 0+30      0+ 2+48
1512    RECON    F4D           1     1     0        1        1800     0+ 0+30     0+ 0+30      0+ 2+48
1712    RECON    F4D           1     1     0        1        2000     0+ 0+30     0+ 0+30      0+ 2+48
1912    RECON    F4D           1     1     0        1        2200     0+ 0+30     0+ 0+30      0+ 2+48
2130    FERRY2   F4D.1         2     2     0        5           0     0+ 0+45     0+ 1+26      0+ 2+30

                SECTION 2

TOTAL SORTIES GENERATED, BY MISSION TYPE

    MSNAME  NO  MISSIONS  NO. SORTIES  FLYING HOURS

      PREFLT          60           60          0.
      RECON          420          600       479.999
      INTRD1         120          240       363.315
      CLSPT1          60          180       137.919
      CLSPT2          60          240       346.120
      INTRD2          60          120       183.858
      INTRD3          60           60        60.000
      FERRY1          60           60       119.923
      FERRY2          60          120       232.238

                SECTION 3
```

FIGURE 9-26. FORM 20 PROCESSING (3 SECTIONS) - SP3.5

```
**** MSG  24 THE FOLLOWING NODES ARE B-MODE CONSTRAINED
      NONE

**** MSG  36 THE FOLLOWING NODES WERE DEFINED AS T SELECTION MODES BUT NEVER USED ON FORM 22 - CHANGED TO D
 NONE

**** MSG  11 E-MODE BRANCHES FROM THE FOLLOWING NODES DO NOT SUM TO 1.0
 NODE    PARAM SUM    TOTAL BRANCHES ALL MODES
 NONE

**** MSG  96 I SEL MODES MAY BE NEEDED IN THE NETWORK AS FOLLOWS" TASK USED CONSUMES A PART AND HAS A VALID DURATION.
 CONTR TABLE  TASK NAME  SELECTION
   INDEX        GIVEN      MODE

    76          UL.BMS        1
    89          UL.MIS        1
    91          UL.SMT        1
   110          REPLH1        1
   134          RPLC11        1
   141          RPLC12        1
   160          INSTL         1

**** MSG  97 I SEL MODE ILLEGALLY USED AT THE FOLLOWING CONTROL TABLE LOCATIONS - CHANGED TO D MODE
 NONE

**** MSG  79 THE FOLLOWING CLOCKS HAVE MEANS LESS THAN OR EQUAL THE VARIANCE OR NONZERO VARIANCES AND A 'C' DISTRIBUTN

  NONE

**** MSG  80 THE FOLLOWING TASKS  HAVE MEANS LESS THAN OR EQUAL THE VARIANCE OR NONZERO VARIANCES AND A 'C' DISTRIBUTN

  NONE

**** MSG   4 THE FOLLOWING TASKS WERE NOT IN THE TASK NETWORK
      THRFLT

**** MSG 146  THE FOLLOWING RESOURCE COMBINATION SETS HAVE BEEN DEFINED WITH THE SAME RESOURCES
RESOURCE COMBINATION SET  SYNONYM
        NONE

**** MSG 147 REDEFINITIONS OF THE FOLLOWING RESOURCE COMBINATION SETS WERE ATTEMPTED AND FLAGGED BY MSG. 56
RESOURCE COMB. SET     REDEFINITION ATTEMPTS
       NONE

**** MSG 117 THE FOLLOWING INTERNAL EQUIPMENT NAMES WERE DEFINED FOR AN AIRCRAFT BUT NEVER USED ON FORM 23
 AIRCRAFT  EQUIPMENT

   NONE

**** MSG  31 COST VALUES PROVIDED FOR THE FOLLOWING RESOURCES
      CAMTEC      1M998
```

FIGURE 9-27. SUMMARY DIAGNOSTICS - SP3.5

**** MSG 17 FORM 11 NODE USAGE REPORT, PART ONE

HEADINGS

INDEX INDEX NUMBER OF FIRST USE OF THE NODE ON FORM 11 AS A PRIOR NODE

CODES * = UNDEFINED NODE X = CALL SECTION MUST NOT REACH A SORTIE
+ = UNUSED NODE R = RECONFIGURATION ENTRY MUST NOT REACH A SORTIE
L = APPARENT STATIC LOOP C = CONDITIONAL SORTIE
U = UNREACHABLE NODE S = SEQUENTIAL SORTIES
P = PARALLEL SORTIES

COL1 NUMBER OF APPEARANCES AS PRIOR NODE ON FORM 11
COL2 NUMBER OF APPEARANCES AS NEXT NODE ON FORM 11
COL3 NUMBER OF APPEARANCES AS CALLED NODE ON FORM 11
COL4 NUMBER OF APPEARANCES AS ENTRY NODE ON FORM 17
COL5 NUMBER OF APPEARANCES AS RECONFIGURATION FORM 21

NODE.NAME	INDEX	CODES	COL1	COL2	COL3	COL4	COL5	NODE.NAME	INDEX	CODES	COL1	COL2	COL3	COL4	COL5
A	1		1	0	6	1	0	B1	2		1	0	0	1	0
F	3		1	P	7	0	0	C5	146		1	1	0	0	0
F1	4		1	1	0	0	0	F2	5		2	1	0	0	0
C1	7		1	1	0	0	0	C11	8		2	1	0	0	0
D	18		1	0	7	0	0	D1	14		2	2	0	0	0
ORD8MS	9		1	0	1	0	0	D1BA	10	L	1	2	0	0	0
D1BB	11		1	1	0	0	0	D1BC	12		2	1	0	0	0
E	16		1	0	4	0	0	G	102		4	4	0	0	3
F1	17		1	1	0	0	0	B2	19		1	0	0	1	0
C2	20		1	1	0	0	0	C22	21		1	1	0	0	0
D2	27		2	2	0	0	0	ORDSMT	22		1	2	1	0	0
D28A	23	L	1	2	0	0	0	D2BB	24		1	1	0	0	0
D28C	25		2	1	0	0	6	B3	29		1	0	0	1	0
B4	30		1	0	0	1	0	C3	31		1	1	0	0	0
C33	32		1	1	0	0	0	D3	38		2	1	0	0	0
ORDMIS	33		1	0	1	0	0	D3BA	34	L	1	2	0	0	0
D3BB	35		1	1	0	0	0	D3BC	36		2	1	0	0	0
B6	40		1	0	0	1	0	C4	41		1	1	0	0	0
C44	42		2	1	0	0	0	D4	43		1	2	0	0	0
B7	44		1	0	0	2	0	C7	152		1	1	0	0	0
B5	45		1	0	0	1	0	C6	149		1	1	0	0	0
RS.BMS	46		2	0	4	0	0	RM1	48	L	1	2	0	0	0
RM2	49		1	1	0	0	0	RB3	50		2	1	0	0	0
RS.SMT	52		2	0	4	0	0	RS1	54	L	1	2	0	0	0
RS2	55		1	1	0	0	0	RS3	56		2	1	0	0	0
RS.MIS	58		2	0	4	0	0	RM1	60	L	1	2	0	0	0
RM2	61		1	1	0	0	0	RM3	62		2	1	0	0	0
Q1B	64		1	0	0	0	1	Q2B	69		1	1	0	0	0
Q1D	65		1	0	0	0	1	Q2D	70		1	1	0	0	0
Q1C	66		1	0	0	0	1	Q2C	71		1	1	0	0	0
Q1E	67		1	0	0	0	2	Q3	68		1	4	0	0	0
Q3A	72		1	0	0	0	6	Q5	76		1	4	0	0	3
Q3D	73		1	0	0	0	3	Q4D	79		1	1	0	0	0
Q3C	74		1	0	0	0	3	Q4C	78		1	1	0	0	0
Q3E	75		1	0	0	0	5	Q4A	77		1	0	0	0	1
Q5A	80		1	0	0	0	2	Q7	84		1	4	0	0	1
Q5C	81		1	0	0	0	1	Q6C	85		1	1	0	0	0
Q5B	82		1	0	0	0	1	Q6D	86		1	1	0	0	0

FIGURE 9-28. NODE USAGE REPORT, PART 1 - SP3.5

Q5E	83	1	0	0	0	2	Q7A	87	1	0	0	0	6
Q9	91	1	4	0	0	3	Q7C	88	1	0	0	0	3
Q8C	92	1	1	0	0	0	Q7D	89	1	0	0	0	3
Q8D	93	1	1	0	0	0	Q7E	90	1	0	0	0	5
Q11A	94	1	0	0	0	4	Q1J	98	1	4	0	0	2
Q11B	95	1	0	0	0	2	Q12B	99	1	1	0	0	0
Q11D	96	1	0	0	0	2	Q12D	101	1	1	0	0	0
Q11C	97	1	0	0	0	2	Q12C	100	1	1	0	0	0
G1	103	1	1	0	0	0	G2	105	1	1	0	0	0
H	106	3	1	0	0	0	H1	108	1	1	0	0	0
J	109	2	1	0	0	0	J1	110	1	1	0	0	0
J2	112	2	1	0	0	0	J3	113	1	1	0	0	0
H2	116	1	1	0	0	0	K	117	2	1	0	0	0
K1	118	1	1	0	0	0	K2	120	2	1	0	0	0
K3	121	1	1	0	0	0	G3	124	1	1	0	0	0
I	125	2	1	0	0	0	I1	127	1	1	0	0	0
L	128	2	1	0	0	0	L1	129	1	1	0	0	0
L2	131	1	1	0	0	0	M	132	2	1	0	0	0
N	133	2	1	0	0	0	N1	134	1	1	0	0	0
N2	136	2	1	0	0	0	N3	137	1	1	0	0	0
P	140	2	1	0	0	0	P1	141	1	1	0	0	0
P2	143	2	1	0	0	0	P3	144	1	1	0	0	0
C55	147	1	1	0	0	0	C66	150	2	1	0	0	0
C77	153	1	1	0	0	0	G4	156	1	1	0	0	0
G5	157	2	1	0	0	0	SUBCAM	159	1	1	0	0	0
G'	162	2	1	0	0	0	R1	160	1	0	0	0	21
ADDCAM	161	1	1	0	0	0							

NOTE: UNDEFINED ARE THOSE NODES WITH COL1 = 0.
UNUSED ARE THOSE WITH COL1 > 0, BUT ALL OTHER COLS = 0
C, P, S, X, R, * ARE FATAL CONDITIONS

FIGURE 9-28. NODE USAGE REPORT, PART 1 - SP3.5 (CONT'D)

FORM 11 NODE USAGE REPORT, PART TWO NODES WITH PARALLEL BRANCHES

NODE NAME	FIRST INDEX /SEL	MODE	PARALLEL INDICES /SEL	MODES		
F2	5	D	6	A		
C11	8	C	148	D		
D1	14	C	15	C		
D18C	12	D	13	D		
G	102	A	104	F	123 F	155 F
D2	27	C	28	C		
D28C	25	D	26	D		
D3	38	C	39	C		
D38C	36	D	37	D		
C44	42	C	154	D		
RS.RMS	46	D	47	D		
RB3	50	D	51	D		
RS.SMT	52	D	53	D		
RS3	56	D	57	D		
RS.MIS	58	D	59	D		
RM3	62	D	63	D		
H	106	A	107	F	115 F	
J	109	D	111	D		
J2	112	E	114	E		
K	117	D	119	D		
K2	120	E	122	E		
I	125	A	126	D		
L	128	D	130	D		
M	132	F	139	F		
N	133	D	135	D		
N2	136	E	138	E		
P	140	D	142	D		
P2	143	E	145	E		
C66	150	C	151	D		
G5	157	E	158	E		
G6	162	R	163	R		

FIGURE 9-28. NODE USAGE REPORT, PART 2 - SP3.5

```
INPUT DATA SUMMARY

 THERE ARE    23 RESOURCES
              96 TASK NAMES
             130 NODE NAMES
             163 CONTROL TABLE ENTRIES
              11 FAILURE CLOCKS
               9 MISSION ENTRY POINTS (IETB)
               3 RESOURCES ENTERING NETWORK (NACO)
               6 TOTAL # OF CONFIGURATIONS DEFINED(ALL A/C) (NCRS)
               9 SEARCH PATTERNS (NSRPT)
              13 NEXT HIGHER FAILURES (NHNF)
              70 TASK RESOURCE REQUIREMENTS (TRR)
               9 UNIQUE GROUPS OF CLOCK DECREMENTS (NOCL)
               1 UNIQUE PIECES OF INTERNAL EQUIPMENT (EQUIP)
               2 INTERNAL EQUIPMENT GROUPS (ILIST)
               2 TRIGGERING EVENTS (NTEVT.DV)
               9 OPERATIONS HEADINGS ON FORM 10
               3 AIRCRAFT   HEADINGS ON FORM 10
              10 PERSONNEL  HEADINGS ON FORM 10
              10 PART       HEADINGS ON FORM 10
               2 AGE        HEADINGS ON FORM 10
```

FIGURE 9-29, INPUT DATA SUMMARY - SP3.5

RESOURCES WITH MAX.AUTHORIZED AND MAX.USED INFO, AND A FLAG THAT = '*' IF MXAUTH IS LESS THAN MXUSE

NO. - NAME	MXAUTH	MXUSE	FLAG	NO. - NAME	MXAUTH	MXUSE	FLAG	NO. - NAME	MXAUTH	MXUSE	FLAG
1 - F4D	18	8		9 - MUNSPL	36	4		17 - SMTBMS	250	4	
2 - CREWCH	18	2		10 - TRUCK	1	1		18 - MISSLS	100	4	
3 - OMPERS	30	3		11 - PUMPH1	1	1		19 - CAMTEC	4	2	
4 - FLTENG	10	1		12 - PUMPH2	1	1		20 - CAMERA	3	1	
5 - HYDTEC	15	2		13 - RDASSY	0	1	*	21 - GENTEC	0	1	*
6 - HYDSPL	10	2		14 - RADC11	1	1		22 - F4D.1	3	0	
7 - COMTEC	10	2		15 - RADC12	1	1		23 - (BLNK)	9999	0	
8 - COMSPL	10	1		16 - BMS500	800	8					

FIGURE 9-30. RESOURCE DICTIONARY - SP3.5

FAILURE CLOCKS

1 - CLCKH1	2 - CLCKH2	3 - CLCK11	4 - CLCK12	5 - CLKBMS	6 - CK2BMS
7 - CLKSMT	8 - CK2SMT	9 - CLKMIS	10 - CK2MIS	11 - CLKCAM	

FIGURE 9-31. FAILURE CLOCK DICTIONARY - SP3.5

TASKS

1 - PREFLT	2 - PRELCH	3 - SORTIE	4 - FUEL	5 - DCRMNT	6 - POSFLT
7 - MMODE1	8 - MMODE4	9 - DECBMS	10 - DCBMS2	11 - GENBMS	12 - DELAYB
13 - MMODE2	14 - MMODE5	15 - DECSMT	16 - DCSMT2	17 - DELAYS	18 - GENSMT
19 - MMODE3	20 - MMODE6	21 - DECMIS	22 - DCMIS2	23 - DELAYM	24 - GENMIS
25 - TSHOOT	26 - MNREP1	27 - HYDISP	28 - HYTSHT	29 - REGBAL	30 - MNHYRP
31 - REMVH1	32 - RCHKH1	33 - TRANH1	34 - REPLH1	35 - INSPH1	36 - REPRH1
37 - DELH1	38 - NRTSH1	39 - REMVH2	40 - RCHKH2	41 - TRANH2	42 - REPLH2
43 - INSPH2	44 - REPRH2	45 - DELH2	46 - NRTSH2	47 - CMDISP	48 - CMTSHT
49 - CMMNRP	50 - REMVC1	51 - RCHKC1	52 - TRANC1	53 - REPLC1	54 - INSPC1
55 - BKDNC1	56 - RMVC11	57 - DELC11	58 - RPLC11	59 - INSC11	60 - AWPC11
61 - REPC11	62 - NRTC11	63 - RMVC12	64 - DELC12	65 - RPLC12	66 - INSC12
67 - AWPC12	68 - REPC12	69 - NRTC12	70 - DL.BMS	71 - RPLBMS	72 - TRNBMS
73 - DL.MIS	74 - RPLMIS	75 - TRNMIS	76 - DL.SMT	77 - RPLSMT	78 - TRNSMT
79 - DL.POD	80 - DL.RCK	81 - UL.RCK	82 - UL.BMS	83 - UL.MIS	84 - UL.SMT
85 - UL.POD	86 - FCAM	87 - TCAM	88 - RCAM	89 - CAMSHP	90 - MCAM
91 - VCAM	92 - VCAM2	93 - INSTL	94 - DFCAM	95 - THRFLT	96 - DUMMY

FIGURE 9-32. TASK DICTIONARY - SP3.5

TASK RESOURCE REQUIREMENTS - DUPLICATES ARE MERGED

USAGE COUNT	RESOURCE	QTY	SUB FLAG	RESOURCE	QTY	SUB FLAG	ETC...
2	CREWCH	1					
1	OMPERS	2					
2	OMPERS	1					
1	CREWCH	1		OMPERS	2		
2	CREWCH	1		GENTEC	1	X	OMPERS 1
2	BMS50099999						
3	(RLNK)99999						
2	SMTBMS99999						
2	MISSLS99999						
2	FLTENG	1					
2	HYDTEC	2					
2	HYDSPL	1		HYDTEC	1		
1	GENTEC	1	X	HYDTEC	1	X	
1	HYDSPL	2	X				
4	HYDSPL	1	X				
2	TRUCK	1		HYDSPL	1	X	
1	PUMPH1	-1		HYDSPL	1	X	
1	PUMPH199999			HYDSPL	1		
2	HYDSPL	1					
1	PUMPH2	-1		HYDSPL	1	X	
1	PUMPH299999			HYDSPL	1		
2	COMTEC	1					
3	COMTEC	2					
2	COMTEC	1		GENTEC	1	X	
1	TRUCK	1		OMPERS	1		
1	RDASSY	-1		COMSPL	1		
1	RDASSY99999			COMSPL	1		
9	COMSPL	1					
1	RADC11	-1		COMSPL	1		
1	RADC1199999			COMSPL	1		
1	RADC12	-1		COMSPL	1		
1	RADC1299999			COMSPL	1		
5	MUNSPL	4					
3	(RLNK)99999			TRUCK	1		MUNSPL 1
3	GENTEC	1	X				
2	CREWCH	2					
1	BMS500	-4		MUNSPL	4		
1	MISSLS	-4		MUNSPL	4		
1	SMTBMS	-4		MUNSPL	4		
2	CAMTEC	1					
2	CAMTEC	2					
1	CAMERA99999			CAMTEC	1		
1	CAMTEC	1		OMPERS	1		
1	CAMERA	-1		CAMTEC	2		

FIGURE 9-33A. TASK RESOURCE REQUIREMENTS - SP3.5

RESOURCE COMBINATION SETS

RESOURCE COMB. SET	NUMBER OF REFERENCES	RESOURCES REFERENCED
FCT1	2	CREWCH OMPERS
FCT2	2	CREWCH GENTEC OMPERS
FCT4	2	HYDSPL HYDTEC
FCT3	2	COMTEC GENTEC

FIGURE 9-33B. RESOURCE COMBINATION SETS - DICTIONARY - SP3.5

OS-6

EXTERNAL CONFIGURATIONS(CLASSES)

AIRCRAFT	INDEX	CLASS	FREQUENCY
F4D	1	RECPOD	19
	2	RMS500	11
	3	RACKS	11
	4	SMTBMS	11
	5	MISSLS	11
	6	CLEAN	22
F4D.1	1	CLEAN	1

**** MSG 53 CLASSES WITH ZERO OR SMALL SEARCH FREQUENCIES MAY CAUSE A/C QUEUEING PROBLEMS

FIGURE 9-34. EXTERNAL CONFIGURATION DICTIONARY - SP 3.5

AIRCRAFT ASSIGNMENT SEARCH PATTERNS

INDEX	NAME	AIRCRAFT	NO.OF.REFS	NO.OF.CLASSES.SEARCHED
1	F4D	F4D	1	8
2	RECON6	F4D	1	15
3	RECON2	F4D	1	15
4	RECON5	F4D	1	8
5	RECON4	F4D	1	8
6	RECON3	F4D	1	8
7	RECON7	F4D	1	15
8	RECON1	F4D	1	8
9	F4D.1	F4D.1	1	1

NOTE - IF FORM 21 NOT USED OR DEFAULT SEARCH PATTERN NOT REDEFINED, THE EXTERNAL CONFIGURATION SEARCH ORDER FOR AN AIRCRAFT'S DEFAULT PATTERN IS AS LISTED IN THE EXTERNAL CONFIGURATIONS DICTIONARY FOR THAT AIRCRAFT.

FIGURE 9-35. AIRCRAFT ASSIGNMENT SEARCH PATTERNS - DICTIONARY - SP3.5

INTERNAL EQUIPMENT BY AIRCRAFT

AIRCRAFT	INDEX	EQUIPMENT	FREQUENCY
F4D	1	CAMERA	2
F4D.1	NONE		

FIGURE 9-36. INTERNAL EQUIPMENT DICTIONARY - SP3.5

INTERNAL EQUIPMENT GROUPS

INDEX	NAME	AIRCRAFT	NO.OF.REFS	NO.OF.EQUIPMENT.REFERENCED
1	1CAM	F4D	24	1
2	0CAM	F4D	21	1

FIGURE 9-37. INTERNAL EQUIPMENT GROUPS - DICTIONARY - SP3.5

CONTROL TABLE

INDEX	TASK - TTID	C	SEL	PAR	NIND	NAIND
1	PREFLT 1		J	0		
2	$ 3		C	0	146	
3	PREFLT 1		J	0	4	
4	DUMMY 96		K	0	5	
5	PRELCH 2		D	0		6
6	REDBAL 29		A	7300		
7	SORTIE 3	-	S	0	8	
8	$ 15		C	0	14	148
9	DELAYM 12		D	0	10	
10	HMODE1 7		H	0	11	
11	DECBMS 9	-	D	0	12	
12	DUMMY 96		D	0	10	13
13	GENBMS 11		D	0		
14	$ 16		C	0	102	15
15	$ 9		C	0		
16	[illegible] 4		D	0	17	
17	POSFLT 6		D	0		
18	DCRMNT 5	-	D	0		
19	$ 3		C	0	20	
20	SORTIE 3	-	S	0	21	
21	$ 18		C	0	27	
22	DELAYS 17		D	0	23	
23	HMODE2 13		H	0	24	
24	DECSMT 15	-	D	0	25	
25	DUMMY 96		D	0	23	26
26	GENSMT 18		D	0		
27	$ 16		C	0	102	28
28	$ 22		C	0		
29	$ 3		C	0	7	
30	$ 3		C	0	31	
31	SORTIE 3	-	S	0	32	
32	$ 18		C	0	38	
33	DELAYM 23		D	0	34	
34	HMODE3 19		H	0	35	
35	DECMIS 21	-	D	0	36	
36	DUMMY 96		D	0	34	37
37	GENMIS 24		D	0		
38	$ 16		C	0	102	39
39	$ 33		C	0		
40	$ 3		C	0	41	
41	SORTIE 3	-	S	0	42	
42	$ 19		C	0	43	154
43	$ 16		C	0	102	
44	$ 3		C	0	152	
45	$ 3		C	0	149	
46	DUMMY 96		D	0	48	47
47	TRNBMS 72		D	0		
48	HMODE4 8		H	0	49	
49	DCBMS2 10	-	D	0	50	
50	DUMMY 96		D	0	48	51
51	RPLBMS 71		D	0		

INDEX	TASK - TTID	C	SEL	PAR	NIND	NAIND
83	DL.POD 79		B	0	84	
84	UL.MIS 83		D	0		
85	$ 46		C	0	84	
86	$ 52		C	0	84	
87	UL.RCK 81		B	0	91	
88	DL.RMS 70		D	0	92	
89	DL.MIS 73		D	0	93	
90	DL.POD 79		B	0	91	
91	UL.SMT 84		D	0		
92	$ 46		C	0	91	
93	$ 58		C	0	91	
94	UL.RCK 81		B	0	98	
95	DL.BMS 70		B	0	99	
96	DL.MIS 73		B	0	101	
97	DL.SMT 76		B	0	100	
98	UL.POD 85		B	0		
99	$ 46		C	0	98	
100	$ 52		C	0	98	
101	$ 56		C	0	98	
102	TSHOOT 25		A	40000	103	104
103	MNREP1 26		B	0		
104	HYDISP 27		F	0	105	123
105	HYTSHT 28		D	0	106	
106	MNHYRP 30		A	60000		107
107	REMVH1 31		F	0	108	115
108	BCHKH1 32		B	0	109	
109	TRANH1 33		B	0	110	111
110	REPLH1 34		D	0		
111	INSPH1 35		B	0	112	
112	REPRH1 36		E	70000	113	114
113	DELH1 37		D	0		
114	NRTSH1 38		E	80000		
115	REMVH2 39		F	0	116	
116	BCHKH2 40		B	0	117	
117	TRANH2 41		D	0	118	119
118	REPLH2 42		D	0		
119	INSPH2 43		B	0	120	
120	REPRH2 44		E	90000	121	122
121	DELH2 45		D	0		
122	NRTSH2 46		E	10000		
123	CMDISP 47		F	0	124	155
124	CMTSHT 48		D	0	125	
125	CMMNRP 49		A	50000		126
126	REMVC1 50		D	0	127	
127	BCHKC1 51		B	0	128	
128	TRANC1 52		D	0	129	130
129	REPLC1 53		I	0		
130	INSPC1 54		B	0	131	
131	BKDNC1 55		D	0	132	
132	RMVC11 56		F	0	133	139
133	DELC11 57		D	0	134	135

FIGURE 9-38. CONTROL TABLE DICTIONARY - SP3.5

CONTROL TABLE

INDEX	TASK - TTID	C	SEL	PAR	NIND	NAIND
52	DUMMY	96	D	0	54	53
53	TRNSMT	78	D	0		
54	HMODE5	14	H	0	55	
55	DCSMT2	16 -	D	0	56	
56	DUMMY	96	D	0	54	57
57	RPLSMT	77	D	0		
58	DUMMY	96	D	0	60	59
59	TRNMIS	75	D	0		
60	HMODE6	20	H	0	61	
61	DCMIS2	22 -	D	0	62	
62	DUMMY	96	D	0	60	63
63	RPLMIS	74	D	0		
64	DL.BMS	70	D	0	69	
65	DL.MIS	73	D	0	70	
66	DL.SMT	76	D	0	71	
67	DL.POD	79	D	0	68	
68	DL.RCK	80	D	0		
69	$	46	C	0	68	
70	$	58	C	0	68	
71	$	52	C	0	68	
72	UL.RCK	81	D	0	76	
73	DL.MIS	73	D	0	79	
74	DL.SMT	76	D	0	78	
75	DL.POD	79	D	0	76	
76	DL.BMS	82	D	0		
77	DL.RCK	80	D	0		
78	$	52	C	0	76	
79	$	58	C	0	76	
80	UL.RCK	81	D	0	84	
81	DL.BMS	70	D	0	85	
82	DL.SMT	76	D	0	86	
134	RPLC11	58	D	0		
135	INSC11	59	D	0	136	
136	AWPC11	60	E	70000	137	138
137	REPC11	61	D	0		
138	NRTC11	62	E	30000		
139	RMVC12	63	F	0	140	
140	DELC12	64	B	0	141	142
141	RPLC12	65	D	0		
142	INSC12	66	B	0	143	
143	AWPC12	67	E	85000	144	145
144	REPC12	68	D	0		
145	NRTC12	69	E	15000		
146	SORTIE	3 -	S	0	147	
147	$	18	C	0	14	
148	DFCAM	94 -	D	0		
149	SORTIE	3 -	S	0	150	
150	$	18	C	0	27	151
151	DFCAM	94 -	D	0		
152	SORTIE	3 -	S	0	153	
153	$	18	C	0	43	
154	DFCAM	94 -	D	0		
155	FCAM	86	F	0	156	
156	TCAM	87	B	0	157	
157	RCAM	88	E	65000	159	158
158	MCAM	90	E	35000	162	
159	CAMSHP	89	T	0		
160	INSTL	93	B	0	161	
161	VCAM	91	T	0		
162	VCAM	91	R	0		163
163	VCAM2	92	R	0		

FIGURE 9-38. CONTROL TABLE DICTIONARY - SP3.5 (CONT'D)

MAIN MODEL INIT FILE IS TO BE PRODUCED
LEGITIMATE END MARKER WRITTEN

```
    208004          96 - - -
```

```
LCOMIT STANDARD VERSION   H.I.S. RELEASE 3.5

 LCOMIT SPEC CARD INFO
SPEC          5
CHNG         11
PRNT          6
INIT          7
EXOG         10
DUMP          8
POST          4
DATA          9
```

FIGURE 9-40. MAIN MODULE SPEC CARD INFO - SP3.5

```
CNTR.DV      163
SEL.CNTR
      2       4       7       8       1       2      10       4       1       5
      1       1       1       4       4       1       1       1       4      10
      6       1       5       1       1       1       4       4       4       4
     10       4       1       5       1       1       1       4       4       4
     10       8       4       4       4       1       1       5       1       1
      1       1       1       5       1       1       1       1       1       5
      1       1       1       1       1       1       1       1       4       4
      1       1       1       1       1       1       1       4       4       1
      1       1       1       4       4       4       1       1       1       1
      1       4       4       1       1       1       1       1       4       4
      4       2       1       3       1       2       3       1       1       1
      1       0       1       0       3       1       1       9       1       0
      1       0       3       4       2       1       4       1       4       1
      1       3       1       1       1       0       1       0       3       1
      1       1       0       1       0      10       4       1      10       4
      1      10       4       1       3       1       0       0      12       1
     12      13      13
      /       /                                                       /       /       /
                              -----OVER TEN PAGES OMITTED-----
SPARE.RESRT
     0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.
     1.0000  1.0000  0.      0.      1.0000  1.0000  1.0000  1.0000  1.0000  1.0000
     1.0000  0.      0.      1.0000  1.0000
     0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      1.0000  0.      1.0000  0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.
     0.      0.      0.      0.      0.      0.      0.      0.
     0.

EQUIP.DV     2
EVANS.EQUIP
        1

        1

QUANS.EQUIP
        1

        0
```

FIGURE 9-41. MAIN MODULE INIT DATA REPORT - SP3.5

```
THE FOLLOWING VARIABLES WERE CHANGED IN SE..N...
        VNAM      IPAR        FPAR          CARD      IPAR2        FPAR2
        RUN          0          0.                     0          0.
        HITMAT       0          0.                     0         60.000000
        HITMAT       0         60.000100               0        100.000000
        STUPAC       6          0.          F4D        0          0.
        GRAPH        0          0.                     0          0.
        PARTSP       0          0.                     0          0.
        SUPONF       0          0.                     0         60.000000
        SWICH       91          0.                     0          0.
ABOVE CHANG.CARD USES FILE  4 IS IT ASSIGNED.
        SWICH      123          0.                     0          0.
ABOVE CHANG.CARD USES FILE  4 IS IT ASSIGNED.
        SWICH      101          0.                     0          0.
        SWICH      111          0.                     0          0.
        TRAKAC      10          0.          F4D        0         15.000000
        TRAKAC       2         16.000000    F4D.1      0         19.000000
        WARMUP      10          0.                     0          0.
        KCYC         5          0.                     0          0.
        TSUB         6          7.000000               95        11.000000
REVERSE SCHEDULED FOR CONTROL INDEX   17
        ISEED        2         85.000000               0          0.
        ISEED        5         99.000000               0          0.
        ISEED        6         77.000000               0          0.
        PRBATT       3          0.          INTRD2     0          0.
        PRBRAM       1          0.          CLSPT2     0          0.
        RAMTME       0           .750000    F4D        0           .075000
        RFREQ        0         10.000000               0          0.
        AUTH         1         19.000000               0          0.
        AUTH        10          2.000000               0          0.
        AUTH        11          3.000000               0          0.
        AUTH        12          6.000000               0          0.
        AUTH        13          4.000000               0          0.
        AUTH        14         65.000000               0          0.
        AUTH        15         37.000000               0          0.
        AUTH        16       9999.000000               0          0.
        AUTH        17       9999.000000               0          0.
        AUTH        18        999.000000               0          0.
        AUTH        20         20.000000               0          0.
        SAUTH        2          1.000000               9          0.
        SAUTH        2          2.000000               5          0.
        SAUTH        2          3.000000               2          0.
        SAUTH        3          1.000000               2          0.
        SAUTH        3          2.000000               11         0.
        SAUTH        3          3.000000               9          0.
        SAUTH        4          1.000000               1          0.
        SAUTH        4          2.000000               2          0.
        SAUTH        4          3.000000               1          0.
        SAUTH        5          1.000000               0          0.
        SAUTH        5          2.000000               1          0.
        SAUTH        5          3.000000               1          0.
        SAUTH        6          1.000000               1          0.
        SAUTH        6          2.000000               3          0.
        SAUTH        6          3.000000               2          0.
        SAUTH        7          1.000000               1          0.
        SAUTH        7          2.000000               8          0.
        SAUTH        7          3.000000               10         0.
```

FIGURE 9-42A. MAIN MODULE CHANGE CARD REPORT - SP3.5

SAUTH	8	1.000000	3	0.
SAUTH	8	2.000000	9	0.
SAUTH	8	3.000000	9	0.
SAUTH	9	1.000000	20	0.
SAUTH	9	2.000000	9	0.
SAUTH	9	3.000000	4	0.
SAUTH	19	1.000000	3	0.
SAUTH	19	2.000000	2	0.
SAUTH	19	3.000000	1	0.
QSTAT	0	3.000000	0	0.
QSTAT	0	6.000000	0	0.
QSTAT	0	9.000000	0	0.
QSTAT	0	12.000000	0	0.
QSTAT	0	15.000000	0	0.
QSTAT	0	30.000000	0	0.
QSTAT	0	45.000000	0	0.
QSTAT	0	60.000000	0	0.
QSTAT	0	100.000000	0	0.
ITEM	0	3.000000	0	0.
ITEM	0	6.000000	0	0.
ITEM	0	9.000000	0	0.
ITEM	0	12.000000	0	0.
ITEM	0	15.000000	0	0.
ITEM	0	30.000000	0	0.
ITEM	0	45.000000	0	0.
ITEM	0	60.000000	0	0.
ITEM	0	100.000000	0	0.
BQSTAT	0	3.000000	0	0.
BQSTAT	0	6.000000	0	0.
BQSTAT	0	9.000000	0	0.
BQSTAT	0	12.000000	0	0.
BQSTAT	0	15.000000	0	0.
BQSTAT	0	30.000000	0	0.
BQSTAT	0	45.000000	0	0.
BQSTAT	0	60.000000	0	0.
BQSTAT	0	100.000000	0	0.
IPSTAT	0	3.000000	0	0.
IPSTAT	0	6.000000	0	0.
IPSTAT	0	9.000000	0	0.
IPSTAT	0	12.000000	0	0.
IPSTAT	0	15.000000	0	0.
IPSTAT	0	30.000000	0	0.
IPSTAT	0	45.000000	0	0.
IPSTAT	0	60.000000	0	0.
IPSTAT	0	75.000000	0	0.
MNSTAT	0	10.417000	0	0.
MNSTAT	0	10.500000	0	0.
MNSTAT	0	10.583000	0	0.
MNSTAT	0	10.670000	0	0.
MNSTAT	0	10.750000	0	0.
STOP	0	100.000000	0	0.

EXOG EVENT TAPE 3.5.BL BEING USED SAMPLE PROBLEM 3.5 BASELINE EXOG

FIGURE 9-42A. MAIN MODUEL CHANGE CARD REPORT - SP3.5 (CONT'D)

AIRCRAFT IDENTITY DICTIONARY

AIRCRAFT TYPE	AIRCRAFT SEQUENCE NO.	AIRCRAFT TAIL-NUMBER (TRN)	TRACKING TIME FROM	TO
F4D	1	83444		
	2	83430		
	3	83416		
	4	83400		
	5	83384		
	6	83368		
	7	83352		
	8	83336		
	9	83320		
	10	83304	0.	15.00
	11	83288		
	12	83272		
	13	83256		
	14	83240		
	15	83224		
	16	83208		
	17	83192		
	18	83176		
	19	83160		
F4D.1	1	83144		
	2	83128	14.00	19.00
	3	83112		

9-428 AIRCRAFT IDENTITY DICTIONARY - SP3.5

FAILURE CLOCKS

NO.	DIST.	MEAN	VARIANCE	INITIAL VALUE	RANDOM VALUE
1	0	4.164062	0.	4.164062	3.599973
2	9	1.000000	0.	.869001	.858080
3	5	2.082031	.208252	1.786521	.769207
4	0	2.082031	0.	2.082031	1.419644
5	0	8.000000	0.	8.000000	5.037253
6	0	8.000000	0.	8.000000	3.847712
7	0	4.000000	0.	4.000000	3.128628
8	0	4.000000	0.	4.000000	1.970121
9	0	4.000000	0.	4.000000	2.152055
10	0	4.000000	0.	4.000000	1.085312
11	0	5.000000	0.	5.000000	1.227245

FIGURE 9-43. MAIN MODULE FAILURE CLOCK REPORT - SP3.5

TASK (T DIST. ONLY)-->	TMEAN (LIKELY)	LOG(MEAN)	TVAR (OPT. + PESS.)	HIGH DRAW	LOW DRAW	(%TVAR*PESS.)
1	.041656		0.	.041656	.041656	
2	.012497	-4.382271	.001249	.015977	.008572	
3	0.		0.	0.	0.	
4	.007080		0.	.007080	.007080	
5	0.		0.	0.	0.	
6	.041656	-3.178298	.004166	.052291	.032283	
7	0.		0.	0.	0.	
8	0.		0.	0.	0.	
9	0.		0.	0.	0.	
10	0.		0.	0.	0.	
11	0.		0.	0.	0.	
12	12.000000	2.484907	1.199219	14.972957	9.527335	
13	0.		0.	0.	0.	
14	0.		0.	0.	0.	
15	0.		0.	0.	0.	
16	0.		0.	0.	0.	
17	12.000000	2.484907	1.199219	14.559566	9.547985	
18	0.		0.	0.	0.	
19	0.		0.	0.	0.	
20	0.		0.	0.	0.	
21	0.		0.	0.	0.	
22	0.		0.	0.	0.	
23	12.000000	2.484907	1.199219	15.197425	9.753764	
24	0.		0.	0.	0.	
25	(.020828)		(.041656)	.030235	.010961	(75000)
26	2.000000	.693147	0	.020833	.001389	
27	.010414	-4.564592	.003471	.019160	.001179	
28	.031235		0.	.031235	.031235	
29	.010414		0.	.020828	.010414	
30	.041656	-3.178298	.020828	.097994	0.	
31	.020828	-3.871445	.002083	.026799	.016647	
32	.020828	-3.871445	.002083	.025284	.016271	
33	.006943	-4.970057	.003471	.014839	0.	
34	.020828	-3.871445	.002083	.028294	.016818	
35	.010414	-4.564592	.003471	.020462	.000613	
36	.031235	-3.466224	.003471	.040887	.024441	
37	1.000000	0.	.499756	2.302702	0.	
38	20.000000	2.995732	6.000000	35.479834	6.345374	
39	.020828	-3.871445	.006943	.040614	.008365	
40	.020828	-3.871445	.006943	.044831	.007792	
41	.006943	-4.970057	.003471	.026481	.002379	
42	.020828	-3.871445	.006943	.039293	.007629	
43	.010414	-4.564592	.001389	.015341	.007281	
44	.031235	-3.466224	.003471	.039429	.024986	
45	2.000000	.693147	.499756	3.049233	.880385	
46	20.000000	2.995732	6.000000	35.469553	6.401856	
47	.010414	-4.564592	.003471	.019816	.000371	
48	.031235	-3.466224	.010414	.061069	.004323	
49	.041656	-3.178298	.020828	.102002	0.	
50	.020828	-3.871445	.002083	.027428	.017170	
51	.041656	-3.178298	.010414	.064032	.015350	
52	.006943	-4.970057	.003471	.015623	0.	
53	.020828	-3.871445	.002083	.024598	.015327	

FIGURE 9-44. MAIN MODULE TASK TIME DISTRIBUTIONS - SP3.5

54	.010414	-4.564592	.001041	.012828	.008023
55	.020828	-3.871445	.002083	.025690	.015279
56	.020828	-3.871445	.002083	.028038	.016266
57	.006943	-4.970057	.003471	.017403	0.
58	.020828	-3.871445	.006943	.038808	.007740
59	.010414	-4.564592	.001041	.013305	.008095
60	.031235	-3.466224	.010414	.056858	.006562
61	.031235	-3.466224	.003124	.040898	.024875
62	20.000000	2.995732	6.000000	31.245374	4.145530
63	.020828	-3.871445	.002083	.025055	.016246
64	.006943	-4.970057	.003471	.017520	0.
65	.020828	-3.871445	.002083	.025144	.017019
66	.010414	-4.564592	.001041	.013318	.008075
67	.031235	-3.466224	.003124	.041371	.021821
68	.031235	-3.466224	.003124	.040277	.022500
69	20.000000	2.995732	6.000000	34.932300	3.294657
70	.049988	-2.995976	.004997	.064355	.041596
71	0.		0.	0.	0.
72	.020828		0.	.020828	.020828
73	.041656	-3.178298	.004166	.051139	.033259
74	0.		0.	0.	0.
75	.020828		0.	.020828	.020828
76	.041656	-3.178298	.004166	.054112	.032358
77	0.		0.	0.	0.
78	.020828		0.	.020828	.020828
79	.016663	-4.094589	.001666	.021585	.013564
80	.012497	-4.382271	.001249	.015293	.010471
81	.020828	-3.871445	.002083	.026508	.016628
82	.041656	-3.178298	.004166	.050317	.029849
83	.045807	-3.083321	.004581	.055215	.035004
84	.049988	-2.995976	.004997	.062397	.038740
85	.041656	-3.178298	.004166	.050771	.032156
86	0.		0.	0.	0.
87	.024994	-3.689124	.002499	.033068	.019107
88	.012497	-4.382271	.001249	.015889	.009422
89	.062469	-2.773077	.006248	.081504	.052390
90	.008331	-4.787736	.000833	.010714	.006668
91	.008331	-4.787736	.000833	.010479	.006275
92	.016663	-4.094589	.001666	.020053	.012472
93	.020828	-3.871445	.002083	.026656	.016944
94	0.		0.	0.	0.
95	.020828	-3.871445	.002083	.027273	.017930
96	0.		0.	0.	0.

TIME .263679 MESSAGE 513 FROM JOB.END..A/C RELEASED AND NOT ASSIGNED BY SEARCH
6.0000 1.0000 0. 0.

FIGURE 9-44. MAIN MODULE TASK TIME DISTRIBUTIONS - SP3.5 (CONT'D)

TIME 2.4039 MISSION DATA AIRCRAFT ASSIGNED

ID	TYPE	NAME	PRI	MIN	MAX	T/O TIME DA HR MN	DURATION DA HR MN	CANCEL-T DA HR MN	TRN	RES.ID	NAME	STATUS
80864	3	INTRD1	1	2	2	2 12 30	0 1 35	0 0 45	83256	1	F4D	40
									83416	1	F4D	101
									83240	1	F4D	101
81258	4	CLSPT1	1	2	3	2 13 18	0 0 24	0 0 33	83368	1	F4D	101
									83208	1	F4D	101
									83430	1	F4D	101
80834	6	INTRD2	1	2	2	2 14 0	0 0 48	0 0 45	83384	1	F4D	40
									83192	1	F4D	101
									82494	-1	F4D	0

FIGURE 9-45. MAIN MODULE MISSION STATUS REPORT - SP3.5

RUN NUMBER SP3.5C AIRCRAFT CLASS/CONFIG STATUS REPORT TIME= 3.000000

STATUS	FLAG	CLASSES... (A/C TYPE F4D						WITH 6 VALID CLASSES)						
READY	0	4	0	12	0	0	1	TOT.FLAG 0	17					
COCKED	20	0	0	0	0	1	0	TOT.FLAG 20	1	TOT.0+20	18	OHND	18	
PROCESSING	>20	1	0	0	0	0	0	TOT.FLAG>20	1	TOT.ALL	19	AUTH	19	TRUST 0

DETAIL REPORT OF IN PROCESS FLAGS

	FLAG	CLASSES					
PSP IND AC	40	0	0	0	0	0	0
PSP MIN AC	60	0	0	0	0	0	0
PSP MNV/SPARE	80	0	0	0	0	0	0
PSP VAL MSN	100	0	0	0	0	0	6
POST MSN PROC	200	1	0	0	0	0	0
FLYING	300	0	0	0	0	0	0
CKD NEW MSN	400	0	0	0	0	0	0
PSP VAL MSN	101	0	0	0	0	0	0
OTHER	250	0	0	0	0	0	0

STATUS	FLAG	CLASSES... (A/C TYPE F4D.1		WITH 1 VALID CLASSES)					
READY	0	1	TOT.FLAG 0	1					
COCKED	20	0	TOT.FLAG 20	0	TOT.0+20	1	OHND	1	
PROCESSING	>20	2	TOT.FLAG>20	2	TOT.ALL	3	AUTH	3	TRUST 0

DETAIL REPORT OF IN PROCESS FLAGS

	FLAG	CLASSES
PSP IND AC	40	0
PSP MIN AC	60	2
PSP MNV/SPARE	80	0
PSP VAL MSN	100	0
POST MSN PROC	200	0
FLYING	300	0
CKD NEW MSN	400	0
PSP VAL MSN	101	0
OTHER	250	0

FIGURE 9-46. MAIN MODULE AIRCRAFT CLASS (CONFIGURATION REPORT - SP3.5)

RUN NUMBER SP3.5C R E S O U R C E D A T A SIMULATION TIME = 30.000000

RES. NUMBER	REPORT COLUMN	RES. TYPE	NO. OF SUBST.	RES COST	AUTH QUAN	ON HAND BAL.	DUE IN BAL.	DUE OUT BAL.	NO. OF DEMANDS	CUTIL. FACTOR	UTIL. OR USHP.	LAST TIME OF UPDATE	
1	1	AIRCRAFT	0	999936.9	17	12	1	0	1355	158.7	0.	0	30.0
2	1	MAN	0	8000.0	9	9	0	0	0	0.	.0	1	0.
3	2	MAN	0	7500.0	2	2	0	0	0	0.	.0	2	0.
4	3	MAN	0	7500.0	1	0	1	0	0	0.	.0	7	0.
5	4	MAN	1	7000.0	0	0	0	0	0	0.	.0	3	0.
6	5	MAN	1	6500.0	1	1	0	0	0	0.	.0	4	0.
7	6	MAN	0	7000.0	1	0	1	0	0	0.	.0	5	0.
8	7	MAN	0	6500.0	3	1	2	0	0	0.	.0	6	0.
9	8	MAN	0	6500.0	4	4	0	0	0	0.	.0	9	0.
10	1	AGE	0	6000.0	2	2	0	0	609	54.5	0.	0	30.0
11	1	PART	0	100.0	3	3	0	0	8	58.5	0.	0	30.0
12	2	PART	0	100.0	6	2	4	0	36	89.4	0.	0	30.0
13	3	PART	0	1000.0	4	0	9	5	542	-19.8	0.	0	30.0
14	4	PART	0	500.0	65	0	69	4	347	483.2	0.	0	30.0
15	5	PART	0	500.0	37	0	42	5	360	289.9	0.	0	30.0
16	6	PART	0	1000.0	9999	9369	0	0	1752	283982.9	0.	0	30.0
17	7	PART	0	18000.0	9999	9775	0	0	600	294106.1	0.	0	30.0
18	8	PART	0	14000.0	999	968	0	0	196	28011.3	0.	0	30.0
19	9	MAN	0	10000.0	1	1	0	0	2	0.	.0	10	0.
20	9	PART	0	2000.0	20	22	0	0	57	399.9	0.	0	30.0
21	10	MAN	0	5000.0	0	0	0	0	0	0.	.0	8	0.
22	2	AIRCRAFT	0	999936.0	3	1	2	1	60	27.8	0.	0	30.0
23	10	OTHER	0	1.0	9999	10277	138	0	0	0.	0.	0	0.

FIGURE 9-47. MAIN MODULE RESOURCE DATA REPORT - SP3.5

RUN NUMBER SP3.5C B A C K O R D E R S T A T U S R E P O R T TIME= 30.000000

TASK ID	JOB PRI	NEXT INDEX	RES ID	TIME IN	TIME OUT	JOB LENGTH	PROC TYPE	RES TYPE	AC FLAG	REQUIRED RES ID	QTY	ID/QTY PAIRS.. ID	QTY	ID	QTY	TRN	PTRN	NET	KNT
65	19	0	13	29.000	0.	.023	ACT	PART		8	1	15	-1			71436	0	79838	1
53	9	0	22	29.454	0.	0.	ACT	ACFT	200	13	-1					83128	0	73764	1
53	9	0	1	29.471	0.	0.	ACT	ACFT	200	13	-1					83384	0	77656	1
58	19	0	13	29.513	0.	.029	ACT	PART		8	1	14	-1			78480	0	73764	1
53	9	0	1	29.525	0.	0.	ACT	ACFT	200	13	-1					83416	0	13480	1
58	19	0	13	29.582	0.	.032	ACT	PART		8	1	14	-1			71522	0	13480	1
65	19	0	13	29.670	0.	.022	ACT	PART		8	1	15	-1			72738	0	78388	1
58	19	0	13	29.747	0.	.027	ACT	PART		8	1	14	-1			79252	0	80858	1
53	9	0	1	29.756	0.	0.	ACT	ACFT	200	13	-1					83256	0	83126	1
53	9	0	1	29.788	0.	0.	ACT	ACFT	200	13	-1					83240	0	80922	1
65	19	0	13	29.833	0.	.022	ACT	PART		8	1	15	-1			82114	0	80922	1
58	19	0	13	29.849	0.	.026	ACT	PART		8	1	14	-1			79698	0	79544	1
65	19	0	13	29.855	0.	.023	ACT	PART		8	1	15	-1			81718	0	80478	2
96	5	44	-22	29.896	0.	0.	MSN	ACFT	0	22	-1					13494	0	79250	1
65	19	0	13	29.990	0.	.025	ACT	PART		8	1	15	-1			82216	0	83270	1

FIGURE 9-49. MAIN MODULE BACKORDER STATUS REPORT - SP3.5

RUN NUMBER SP3.5C IN PROCESS STATUS REPORT TIME= 30.000000

TASK ID	JOB PRI	NEXT INDEX	RES ID	TIME IN	TIME OUT	JOB LENGTH	PROC TYPE	RES TYPE	AC FLAG	..REQUIRED RES ID/QTY PAIRS.. ID	QTY	ID	QTY	ID	QTY	TRN	PTRN	NET	KNT
69	19	0	15	1.683	32.726	31.043	ACT	PART								81102	0	82128	1
62	19	0	14	2.566	35.283	32.717	ACT	PART								81246	0	83334	1
69	19	0	15	2.758	35.994	33.243	ACT	PART								80798	0	81926	1
62	19	0	14	2.878	33.811	30.934	ACT	PART								80774	0	83142	1
62	19	0	14	3.626	35.758	32.181	ACT	PART								80194	0	80894	1
69	19	0	15	4.645	32.896	27.251	ACT	PART								79446	0	81918	1
62	19	0	14	5.555	36.894	31.339	ACT	PART								78698	0	79494	1
62	19	0	14	5.775	36.249	30.476	ACT	PART								78456	0	80858	1
69	19	0	15	6.661	35.542	28.888	ACT	PART								76174	0	79758	1
62	19	0	14	6.823	33.446	26.624	ACT	PART								77756	0	79882	1
69	19	0	15	7.888	35.512	27.712	ACT	PART								77780	0	77862	1
69	19	0	15	8.136	30.495	22.359	ACT	PART								77402	0	77342	1
62	19	0	14	9.165	31.864	22.699	ACT	PART								76598	0	76818	1
62	19	0	14	9.496	33.487	23.991	ACT	PART								76758	0	77828	1
62	19	0	14	9.511	31.706	22.286	ACT	PART								76258	0	81928	1
62	19	0	14	9.829	36.923	27.894	ACT	PART								79638	0	78778	1
69	19	0	15	9.891	38.352	28.461	ACT	PART								75922	0	76714	1
62	19	0	14	9.928	32.143	22.215	ACT	PART								76198	0	79482	1
69	19	0	15	10.574	36.089	25.515	ACT	PART								75996	0	76888	1
62	19	0	14	10.582	39.277	28.694	ACT	PART								76282	0	76828	1
62	19	0	14	10.928	31.337	20.409	ACT	PART								73826	0	76542	1
62	19	0	14	11.588	30.398	18.810	ACT	PART								75812	0	73762	1
69	19	0	15	11.872	35.465	23.593	ACT	PART								76538	0	73248	1
69	19	0	15	12.569	33.539	20.971	ACT	PART								73462	0	72788	1
62	19	0	14	12.796	35.037	22.241	ACT	PART								72546	0	72782	1
69	19	0	15	12.918	34.393	21.474	ACT	PART								72384	0	73774	1
69	19	0	15	13.474	31.526	18.052	ACT	PART								81388	0	83382	1
69	19	0	15	13.791	30.523	16.732	ACT	PART								72584	0	83174	1
62	19	0	14	13.798	38.652	24.854	ACT	PART								72466	0	73658	1
69	19	0	15	14.482	32.973	18.491	ACT	PART								82684	0	83414	1
62	19	0	14	14.561	39.410	24.849	ACT	PART								72192	0	72778	1
62	19	0	14	14.589	43.147	28.558	ACT	PART								81488	0	72126	1
69	19	0	15	14.725	38.757	24.032	ACT	PART								81844	0	81528	1
62	19	0	14	14.732	45.062	30.330	ACT	PART								81866	0	83878	1
62	19	0	14	14.772	34.339	19.567	ACT	PART								72492	0	72252	1
69	19	0	15	14.772	34.106	19.334	ACT	PART								73726	0	72252	1
62	19	0	14	14.876	31.932	17.056	ACT	PART								73808	0	72688	1
62	19	0	14	15.066	36.203	21.137	ACT	PART								81448	0	71972	1
62	19	0	14	15.461	32.103	16.641	ACT	PART								81198	0	71968	1
69	19	0	15	15.465	37.348	21.984	ACT	PART								71788	0	71968	1
62	19	0	14	15.781	35.398	19.697	ACT	PART								71696	0	81922	1
69	19	0	15	15.728	37.694	21.974	ACT	PART								71598	0	72866	1
62	19	0	14	15.784	40.388	24.516	ACT	PART								82672	0	73258	1
62	19	0	14	15.863	36.902	21.839	ACT	PART								71672	0	72868	1
69	19	0	15	15.878	33.642	17.773	ACT	PART								72298	0	81472	1
17	9	23	23	16.396	31.678	15.282	ACT	OTHER								79262	0	71546	1
69	19	0	15	16.482	50.028	33.546	ACT	PART								81928	0	82126	1

FIGURE 9-48. MAIN MODULE IN PROCESS STATUS REPORT - SP3.5

-----OVER 10 PAGES ARE OMITTED-----

17	9	23	23	29.387	41.167	11.780	ACT	OTHER							72678	0	73522	1
17	9	23	23	29.387	41.643	12.256	ACT	OTHER							77864	0	81524	1
17	9	23	23	29.387	41.760	12.373	ACT	OTHER							77076	0	82268	1
62	19	0	14	29.518	41.856	12.338	ACT	PART							80122	0	73764	1
62	19	0	14	29.521	42.371	12.850	ACT	PART							71856	0	77656	1
45	19	0	12	29.544	31.551	2.007	ACT	PART							77382	0	77380	1
12	9	10	23	29.582	40.774	11.192	ACT	OTHER							80846	0	77468	1
12	9	10	23	29.582	42.094	12.512	ACT	OTHER							79868	0	83126	1
12	9	10	23	29.582	42.936	13.354	ACT	OTHER							81544	0	80888	1
69	19	0	15	29.584	57.184	27.600	ACT	PART							76294	0	83366	1
12	9	10	23	29.612	39.824	10.212	ACT	OTHER							70910	0	80922	1
12	9	10	23	29.612	42.218	12.606	ACT	OTHER							77632	0	79544	1
23	9	34	23	29.648	41.204	11.556	ACT	OTHER							71844	0	80478	1
23	9	34	23	29.648	41.376	11.727	ACT	OTHER							79898	0	73018	1
62	19	0	14	29.808	48.704	18.896	ACT	PART							77940	0	77468	1
69	19	0	15	29.815	49.195	19.380	ACT	PART							77602	0	77468	1
69	19	0	15	29.817	41.455	11.638	ACT	PART							79470	0	83126	1
25	0	103	1	29.981	30.011	.030	ACT	ACFT	200	4	1				83208	0	80896	2
48	9	125	1	29.990	30.019	.029	ACT	ACFT	200	7	1				83208	0	80896	2
67	19	144	15	29.995	30.022	.028	ACT	PART		8	1				78546	0	83270	1
58	19	0	13	29.998	30.019	.022	ACT	PART		8	1	14	-1		81718	0	80478	2

FIGURE 9-48. MAIN MODULE IN PROCESS STATUS REPORT - SP3.5 (CONT'D)

MOST TROUBLESOME REPORT

MOST TROUBLESOME SUPPLY ITEMS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MOST TROUBLESOME PERSONNEL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MOST TROUBLESOME EQUIPMENT ITEMS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

FIGURE 9-50. MAIN MODULE MOST TROUBLE REPORT - SP3.5

RUN NUMBER SP3.5C PERFORMANCE SUMMARY PERIOD FROM 20.0 TO 30.0 LEVEL 1

	OPERATIONS	TOTAL	RECON	INTRD1	CLSPT1	CLSPT2	INTRD2	INTRD3	FERRY1	FERRY2	OTHER
1	NUMBER OF MISSIONS REQUESTED	149.00	70.00	20.00	10.00	10.00	10.00	10.00	10.00	9.00	0.
2	NUMBER ACCOMPLISHED	128.00	62.00	19.00	10.00	10.00	2.00	10.00	10.00	5.00	0.
3	PERCENT ACCOMPLISHED	85.91	88.57	95.00	100.00	100.00	20.00	100.00	100.00	55.56	0.
6	NUMBER OF SORTIES REQUESTED	268.00	100.00	40.00	30.00	40.00	20.00	10.00	10.00	18.00	0.
7	NUMBER ACCOMPLISHED	225.00	85.00	38.00	28.00	40.00	4.00	10.00	10.00	10.00	0.
8	PERCENT ACCOMPLISHED	83.96	85.00	95.00	93.33	100.00	20.00	100.00	100.00	55.56	0.
T1	NUMBER OF WEATHER CANCELS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T2	NUMBER OF WEATHER DELAYS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T3	NUMBER OF ALERT REPLENISHMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T4	NUMBER OF ATTRITIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T5	NUMBER OF RAM REPAIRS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T6	NUMBER OF AIR ABORTS(TOTAL)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	AIRCRAFT	TOTAL	F4D	F4D.1	OTHER
13	NUMBER OF AIRCRAFT AUTH.(EOP)	20.00	17.00	3.00	0.
14	NUMBER OF AIRCRAFT-DAYS AVAIL	200.00	170.00	30.00	0.
15	PCT SORTIES(INCL ALERT)	5.20	5.60	2.93	0.
16	PCT UNSCHED MAINTENANCE	14.60	16.50	3.79	0.
17	PCT SCHED MAINTENANCE	8.65	9.49	3.86	0.
18	PCT NORS	26.12	24.01	38.07	0.
19	PCT MISSION WAIT STATUS	7.00	7.78	2.59	0.
20	PCT SERVICE + WAITING	2.82	2.18	6.42	0.
21	PCT OPERATIONALLY READY	35.62	34.44	42.33	0.
22	AVG. AC POST SORTIE TIME(HRS)	9.23	8.07	30.20	0.
23	AVG. NO. OF SORTIES/ A/C /DAY	1.12	1.26	.33	0.
24	FLYING HOURS	249.58	228.48	21.10	0.
T7	NUMBER OF FCF TASKS FLOWN	0.	0.	0.	0.
T8	AVG. AC PRESORTIE TIME(HRS)	1.58	1.60	1.13	0.

	PERSONNEL	TOTAL	CREWCH	OMPERS	FLTENG	HYDTEC	HYDSPL	COMTEC	COMSPL	MUNSPL	CAMTEC	OTHER
27	MANHOURS AVAILABLE (100)	105.00	12.80	17.60	3.20	1.60	4.80	15.20	16.80	28.00	5.00	0.
28	PERCENT UTILIZATION	31.49	19.90	34.15	20.94	9.98	13.85	48.20	40.18	28.97	16.71	0.
29	MANHOURS USED (100)	33.07	2.55	6.01	.67	.16	.66	7.33	6.74	8.11	.84	0.
30	PCT UNSCHED MAINT. OF STAT 29	75.25	4.64	4.28	100.00	100.00	100.00	99.97	100.00	100.00	100.00	0.
31	PCT SCHED MAINT. OF STAT 29	24.75	95.36	95.72	0.	0.	0.	.03	0.	0.	0.	0.
P1	PCT PRIME OF STAT 29	97.43	80.11	100.00	100.00	83.25	54.96	99.76	100.00	100.00	100.00	0.
P2	PCT SUBSTITUTE OF STAT 29	2.57	19.89	0.	0.	16.75	45.04	.24	0.	0.	0.	0.
33	NUMBER OF MEN DEMANDED	5614.00	386.00	1296.00	158.00	52.00	75.00	1117.00	1515.00	837.00	178.00	0.
P3	MPH OF MEN DEMANDED POST SCAN	5614.00	454.00	1228.00	158.00	27.00	87.00	1097.00	1515.00	837.00	178.00	33.00
34	% AVAIL BY OH. BAL. OF RES	93.09	98.68	93.81	92.41	88.89	89.66	85.14	98.35	93.67	95.51	0.
35	% AVAIL BY GEN SURS OF RES	.71	0.	0.	0.	3.70	6.90	0.	0.	0.	0.	100.00
36	% AVAIL BY EXPEDITE PROC.	.04	.44	0.	0.	0.	0.	0.	0.	0.	0.	0.
37	% AVAIL BY PREEMPTION PROC.	.07	.66	0.	0.	0.	0.	0.	0.	0.	.56	0.
38	% DEMANDS NOT AVAIL FOR RES	6.09	.22	6.19	7.59	7.41	3.45	14.86	1.65	6.33	3.93	0.
39	OVERTIME MANHOURS USED (100)	.07	0.	0.	.01	0.	0.	.04	.00	.01	.01	0.
40	SIMULATED MH PER FLYING HOUR	13.25	1.02	2.41	.27	.06	.27	2.94	2.78	3.25	.33	0.

FIGURE 9-51. MAIN MODULE PERFORMANCE SUMMARY REPORT (LEVEL 1) - SP3.5

RUN NUMBER SP3.5C PERFORMANCE SUMMARY PERIOD FROM 28.0 TO 30.0 LEVEL 1

	SHOP REPAIR	TOTAL	PUMPH1	PUMPH2	RDASSY	RADC11	RADC12	BMS500	SMTBMS	MISSLS	CAMERA	OTHER
44	NO. OF REPARABLE GENERATIONS	1332.00	2.00	11.00	159.00	106.00	109.00	616.00	212.00	100.00	17.00	0.
45	PCT BASE REPAIR	32.88	50.00	72.73	100.00	69.81	87.16	10.39	0.	20.00	100.00	0.
46	PCT DEPOT REPAIR	67.12	50.00	27.27	0.	30.19	12.84	89.61	100.00	80.00	0.	0.
47	AVERAGE BASE REPAIR CYCLE	.30	1.01	1.99	.62	.07	.07	0.	0.	0.	.06	0.
48	PCT ACTIVE REPAIR	99.99	100.00	100.00	100.00	100.00	100.00	0.	0.	0.	98.21	0.
49	PCT WHITE SPACE	.01	0.	0.	0.	0.	0.	0.	0.	0.	1.79	0.
50	NO. OF ITEMS IN REPAIR (EOP)	3.00	0.	1.00	1.00	0.	1.00	0.	0.	0.	0.	0.
51	NO. OF ITEMS BACKLOGGED (EOP)	121.00	0.	3.00	8.00	69.00	41.00	0.	0.	0.	0.	0.

	SUPPLY	TOTAL	PUMPH1	PUMPH2	RDASSY	RADC11	RADC12	BMS500	SMTBMS	MISSLS	CAMERA	OTHER
54	TOT DOLLAR INVEST.(1000)(EOP)	204074.90	.30	.60	4.00	32.50	18.50	9999.00	1.88E 05	13986.00	52.00	0.
55	FILL RATE PERCENT	70.74	100.00	100.00	2.52	3.77	3.67	100.00	100.00	100.00	100.00	0.
56	NUMBER OF BACKORDER-DAYS	136.51	0.	0.	52.31	63.95	20.26	0.	0.	0.	0.	0.
57	NUMBER OF UNITS DEMANDED	1237.00	2.00	11.00	159.00	106.00	109.00	592.00	200.00	40.00	18.00	0.
58	PCT OFF-THE-SHELF	70.74	100.00	100.00	2.52	3.77	3.67	100.00	100.00	100.00	100.00	0.
59	PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60	PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61	PCT DEMANDS NOT SATIS.	29.26	0.	0.	97.48	96.23	96.33	0.	0.	0.	0.	0.
62	NUMBER OF CANNIBALIZATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
63	NO. ITEMS ON BACKORDER (EOP)	14.00	0.	0.	5.00	4.00	5.00	0.	0.	0.	0.	0.

	EQUIPMENT	TOTAL	TRUCK	OTHER
68	TOT DOLLAR INVEST.(1000)(EOP)	12.00	12.00	0.
69	EQUIPMENT HOURS AUTH. (100)	4.80	4.80	0.
70	EQUIPMENT HOURS AVAIL. (100)	4.80	4.80	0.
71	PCT USED-UNSCHED MAINT	7.02	7.02	0.
72	PCT USED-SCHED MAINT	0.	0.	0.
73	PCT UNUSED	92.98	92.98	0.
74	NUMBER OF BACKORDER-DAYS	.02	.02	0.
75	NUMBER OF UNITS DEMANDED	185.00	185.00	0.
76	PCT AVAILABLE	97.84	97.84	0.
77	PCT PROV. BY EXPEDITE	0.	0.	0.
78	PCT PROV. BY PREEMPTION	0.	0.	0.
79	PCT DEMANDS NOT SATIS.	2.16	2.16	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	0.	0.	0.

FIGURE 9-51. MAIN MODULE PERFORMANCE SUMMARY REPORT (LEVEL 1) - SP3.5 (CONT'D)

RUN NUMBER SP3.5C PERFORMANCE SUMMARY PERIOD FROM 10.0 TO 60.0 LEVEL 2

	OPERATIONS	TOTAL	RECON	INTRD1	CLSPT1	CLSPT2	INTRD2	INTRD3	FERRY1	FERRY2	OTHER
1	NUMBER OF MISSIONS REQUESTED	749.00	350.00	100.00	50.00	50.00	50.00	50.00	50.00	49.00	0.
2	NUMBER ACCOMPLISHED	681.00	324.00	95.00	45.00	50.00	27.00	50.00	48.00	42.00	0.
3	PERCENT ACCOMPLISHED	90.92	92.57	95.00	90.00	100.00	54.00	100.00	96.00	85.71	0.
6	NUMBER OF SORTIES REQUESTED	1348.00	500.00	200.00	150.00	200.00	100.00	50.00	50.00	98.00	0.
7	NUMBER ACCOMPLISHED	1202.00	452.00	190.00	124.00	200.00	54.00	50.00	48.00	84.00	0.
8	PERCENT ACCOMPLISHED	89.17	90.40	95.00	82.67	100.00	54.00	100.00	96.00	85.71	0.
T1	NUMBER OF WEATHER CANCELS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T2	NUMBER OF WEATHER DELAYS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T3	NUMBER OF ALERT REPLENISHMENT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
T4	NUMBER OF ATTRITIONS	4.00	0.	0.	0.	0.	4.00	0.	0.	0.	0.
T5	NUMBER OF RAM REPAIRS	1.00	0.	0.	0.	1.00	0.	0.	0.	0.	0.
T6	NUMBER OF AIR ABORTS(TOTAL)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	AIRCRAFT	TOTAL	F4D	F4D.1	OTHER
13	NUMBER OF AIRCRAFT AUTH.(EOP)	18.00	15.00	3.00	0.
14	NUMBER OF AIRCRAFT-DAYS AVAIL	959.52	809.52	150.00	0.
15	PCT SORTIES(INCL ALERT)	6.15	6.41	4.77	0.
16	PCT UNSCHED MAINTENANCE	16.11	18.10	5.37	0.
17	PCT SCHED MAINTENANCE	9.40	10.23	4.94	0.
18	PCT NORS	13.32	12.71	16.65	0.
19	PCT MISSION WAIT STATUS	7.61	8.29	3.97	0.
20	PCT SERVICE + WAITING	3.23	2.34	8.00	0.
21	PCT OPERATIONALLY READY	44.16	41.92	56.30	0.
22	AVG. AC POST SORTIE TIME(HRS)	6.29	5.71	13.75	0.
23	AVG. NO. OF SORTIES/ A/C /DAY	1.25	1.38	.56	0
24	FLYING HOURS	1417.26	1245.68	171.58	0.
17	NUMBER OF FCF TASKS FLOWN	0.	0.	0.	0.
T8	AVG. AC PRESORTIE TIME(HRS)	1.53	1.58	.91	0.

	PERSONNEL	TOTAL	CREWCH	OMPERS	FLTENG	HYDTEC	HYDSPL	COMTEC	COMSPL	MUNSPL	CAMTEC	OTHER
27	MANHOURS AVAILABLE (100)	525.00	64.00	88.00	16.00	8.00	24.00	76.00	84.00	140.00	25.00	0.
28	PERCENT UTILIZATION	33.26	19.99	36.63	24.36	12.04	17.35	52.05	41.69	29.70	17.72	0.
29	MANHOURS USED (100)	174.64	12.79	32.24	3.90	.96	4.16	39.56	35.02	41.58	4.43	0.
30	PCT UNSCHED MAINT. OF STAT 29	75.26	3.33	4.43	100.00	100.00	99.75	99.94	100.00	100.00	100.00	0.
31	PCT SCHED MAINT. OF STAT 29	24.74	96.67	95.57	0.	0.	.25	.06	0.	0.	0.	0.
P1	PCT PRIME OF STAT 29	97.28	79.80	99.98	100.00	78.31	57.50	99.55	100.00	100.00	100.00	0.
P2	PCT SUBSTITUTE OF STAT 29	2.72	20.20	.02	0.	21.69	42.50	.45	0.	0.	0.	0.
33	NUMBER OF MEN DEMANDED	29548.00	1957.00	6848.00	926.00	308.00	484.00	5904.00	7874.00	4315.00	932.00	0.
P3	NBR OF MEN DEMANDED POST SCAN	29548.00	2299.00	6506.00	926.00	168.00	547.00	5799.00	7874.00	4315.00	932.00	182.00
34	% AVAIL BY OH, BAL. OF RES	92.10	98.78	92.10	92.44	76.79	85.56	85.39	97.18	93.12	94.64	0.
35	% AVAIL BY GEN SUBS OF RES	.80	0.	0.	0.	7.14	7.86	0.	0.	0.	0.	100.00
36	% AVAIL BY EXPEDITE PROC.	.06	.48	0.	0.	0.	0.	0.	0.	0.	.64	0.
37	% AVAIL BY PREEMPTION PROC.	.06	.43	0.	0.	0.	.18	0.	0.	0.	.75	0.
38	% DEMANDS NOT AVAIL FOR RES	6.98	.30	7.90	7.56	16.07	6.40	14.61	2.98	6.88	3.97	0.
39	OVERTIME MANHOURS USED (100)	.47	.01	.02	.04	.00	.00	.16	.02	.20	.02	0.
40	SIMULATED MH PER FLYING HOUR	12.32	.90	2.27	.28	.07	.29	2.79	2.47	2.93	.31	0.

FIGURE 9-52. MAIN MODULE PERFORMANCE SUMMARY REPORT (LEVEL 2) - SP3.5

RUN NUMBER SP3.5C PERFORMANCE SUMMARY PERIOD FROM 18.0 TO 60.0 LEVEL 2

	SHOP REPAIR	TOTAL	PUMPH1	PUMPH2	RDASSY	RADC11	RADC12	BMS500	SMTBMS	MISSLS	CAMERA	OTHER
44	NO. OF REPARABLE GENERATIONS	6178.00	14.00	64.00	843.00	539.00	577.00	2742.00	968.00	337.00	94.00	0.
45	PCT BASE REPAIR	36.37	85.71	89.06	100.00	71.43	82.84	9.34	0.	36.20	100.00	0.
46	PCT DEPOT REPAIR	63.63	14.29	10.94	0.	28.57	17.16	90.66	100.00	63.80	0.	0.
47	AVERAGE BASE REPAIR CYCLE	.21	1.24	2.04	.33	.08	.07	0.	0.	0.	.06	0.
48	PCT ACTIVE REPAIR	99.93	100.00	100.00	100.00	100.00	100.00	0.	0.	0.	94.63	0.
49	PCT WHITE SPACE	.07	0.	0.	0.	0.	0.	0.	0.	0.	5.37	0.
50	NO. OF ITEMS IN REPAIR (EOP)	7.00	0.	2.00	2.00	2.00	1.00	0.	0.	0.	0.	0.
51	NO. OF ITEMS BACKLOGGED (EOP)	96.00	0.	4.00	0.	59.00	33.00	0.	0.	0.	0.	0.

	SUPPLY	TOTAL	PUMPH1	PUMPH2	RDASSY	RADC11	RADC12	BMS500	SMTBMS	MISSLS	CAMERA	OTHER
54	TOT DOLLAR INVEST.(1000)(EOP)	204074.90	.30	.60	4.00	32.50	18.50	9999.00	1.88E 05	13986.00	52.00	0.
55	FILL RATE PERCENT	82.61	100.00	84.62	41.78	62.89	33.80	100.00	100.00	100.00	100.00	0.
56	NUMBER OF BACKORDER-DAYS	343.99	0.	6.49	121.89	85.34	130.27	0.	0.	0.	0.	0.
57	NUMBER OF UNITS DEMANDED	6232.00	14.00	65.00	843.00	539.00	577.00	2760.00	1080.00	336.00	96.00	0.
58	PCT OFF-THE-SHELF	82.61	100.00	84.62	41.78	62.89	33.80	100.00	100.00	100.00	100.00	0.
59	PCT EXPEDITED REPAIR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60	PCT PREEMPTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
61	PCT DEMANDS NOT SATIS.	17.39	0.	15.38	58.22	37.11	66.20	0.	0.	0.	0.	0.
62	NUMBER OF CANNIBALIZATIONS	2.00	0.	1.00	1.00	0.	0.	0.	0.	0.	0.	0.
63	NO. ITEMS ON BACKORDER (EOP)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	EQUIPMENT	TOTAL	TRUCK	OTHER
68	TOT DOLLAR INVEST.(1000)(EOP)	12.00	12.00	0.
69	EQUIPMENT HOURS AUTH. (100)	24.00	24.00	0.
70	EQUIPMENT HOURS AVAIL. (100)	24.00	24.00	0.
71	PCT USED-UNSCHED MAINT	7.69	7.69	0.
72	PCT USED-SCHED MAINT	0.	0.	0.
73	PCT UNUSED	92.31	92.31	0.
74	NUMBER OF BACKORDER-DAYS	.10	.10	0.
75	NUMBER OF UNITS DEMANDED	984.00	984.00	0.
76	PCT AVAILABLE	97.76	97.76	0.
77	PCT PROV. BY EXPEDITE	.10	.10	0.
78	PCT PROV. BY PREEMPTION	0.	0.	0.
79	PCT DEMANDS NOT SATIS.	2.13	2.13	0.
80	EQUIP HOURS BACKLOG(100)(EOP)	0.	0.	0.

FIGURE 9-52. MAIN MODULE PERFORMANCE SUMMARY REPORT (LEVEL 2) - SP3.5 (CONT'D)

RUN NUMBER SP3.5C HIT MATRIX FROM TIME 0. TO 60.000000

FROM	BRANCH TO	BRANCH ALT	TASK	PROC ATTEMPT	PROC INIT'D	PARAM VALUE	SEL MODE	FROM	BRANCH TO	BRANCH ALT	TASK	PROC ATTEMPT	PROC INIT'D	PARAM VALUE	SEL MODE
1	0	0	1	889	251	0	J	83	84	0	79	32	32	0	D
2	146	0	3	168	0	0	C	84	0	0	83	105	105	0	D
3	4	0	1	1723	505	0	J	85	84	0	46	0	0	0	C
4	5	0	96	1723	1723	0	K	86	84	0	52	0	0	0	C
5	0	6	2	1723	1542	0	D	87	91	0	81	8	8	0	D
6	0	0	29	1723	11	730	A	88	92	0	70	0	0	0	D
7	8	0	3	587	230	0	S	89	93	0	73	0	0	0	D
8	14	148	18	230	0	0	C	90	91	0	79	3	3	0	D
9	10	0	12	384	384	0	D	91	0	0	84	300	300	0	D
10	11	0	7	2797	2486	0	H	92	91	0	46	0	0	0	C
11	12	0	9	2486	2486	0	D	93	91	0	58	0	0	0	C
12	10	13	96	2486	2486	0	D	94	98	0	81	20	20	0	D
13	0	0	11	2486	2486	0	D	95	99	0	70	33	33	0	D
14	102	15	13	384	0	0	C	96	101	0	73	11	11	0	D
15	0	0	9	384	0	0	C	97	100	0	76	0	0	0	D
16	17	0	4	1468	1468	0	D	98	0	0	85	177	177	0	D
17	0	0	6	1468	1468	0	D	99	98	0	46	33	0	0	C
18	0	0	5	1468	1468	0	D	100	93	0	52	0	0	0	C
19	20	0	3	240	0	0	C	101	98	0	58	11	0	0	C
20	21	0	3	480	240	0	S	102	103	104	25	1468	563	40000	A
21	27	0	18	240	0	0	C	103	0	0	26	563	563	0	D
22	23	0	17	300	300	0	D	104	105	123	27	1468	87	0	F
23	24	0	13	1210	968	0	H	105	106	0	28	87	87	0	D
24	25	0	15	968	968	0	D	106	0	107	30	87	51	60000	A
25	23	26	96	968	968	0	D	107	108	115	31	87	17	0	F
26	0	0	18	968	968	0	D	108	109	0	32	17	17	0	D
27	102	28	16	300	0	0	C	109	110	111	33	17	17	0	D
28	0	0	22	300	0	0	C	110	0	0	34	17	17	0	D
29	7	0	3	316	0	0	C	111	112	0	35	17	17	0	D
30	31	0	3	123	0	0	C	112	113	114	36	17	14	70000	E
31	32	0	3	214	74	0	S	113	0	0	37	14	14	0	D
32	38	0	18	70	0	0	C	114	0	0	38	17	3	30000	E
33	34	0	23	70	70	0	D	115	116	0	39	87	71	0	F
34	35	0	19	269	215	0	H	116	117	0	40	71	71	0	D
35	36	0	21	215	215	0	D	117	118	119	41	71	71	0	D
36	34	37	96	215	215	0	D	118	0	0	42	72	72	0	I
37	0	0	24	215	215	0	D	119	120	0	43	71	71	0	D
38	102	39	16	70	0	0	C	120	121	122	44	71	63	90000	E
39	0	0	33	70	0	0	C	121	0	0	45	63	63	0	D
40	41	0	3	648	0	0	C	122	0	0	46	71	8	10000	E
41	42	0	3	1217	552	0	S	123	124	155	47	1468	1039	0	F
42	43	154	18	552	0	0	C	124	125	0	48	1038	1038	0	D
43	102	0	16	714	0	0	C	125	0	126	49	1038	517	50000	A
44	152	0	3	168	0	0	C	126	127	0	50	1038	1038	0	D
45	149	0	3	60	0	0	C	127	128	0	51	1038	1038	0	D
46	48	47	96	33	33	0	D	128	129	130	52	1038	1038	0	D
47	0	0	72	33	33	0	D	129	0	0	53	1039	1039	0	I
48	49	0	8	293	260	0	H	130	131	0	54	1038	1038	0	D
49	50	0	10	260	260	0	D	131	132	0	55	1038	1038	0	D
50	48	51	96	260	260	0	D	132	133	139	56	1037	662	0	F
51	0	0	71	260	260	0	D	133	134	135	57	662	662	0	D

FIGURE 9-53. MAIN MODULE HIT MATRIX REPORT - SP3.

RUN NUMBER SP3.5C HIT MATRIX FROM TIME 0. TO 60.000000

FROM	BRANCH TO	BRANCH ALT	TASK	PROC ATTEMPT	PROC INIT'D	PARAM VALUE	SEL MODE	FROM	BRANCH TO	BRANCH ALT	TASK	PROC ATTEMPT	PROC INIT'D	PARAM VALUE	SEL MODE
52	54	53	96	0	0	0	D	134	0	0	58	662	662	0	D
53	0	0	78	0	0	0	D	135	136	0	59	662	662	0	D
54	55	0	14	0	0	0	H	136	137	138	60	662	465	70000	E
55	56	0	16	0	0	0	D	137	0	0	61	464	464	0	D
56	54	57	96	0	0	0	D	138	0	0	62	662	197	30000	E
57	0	0	77	0	0	0	D	139	140	0	63	1037	704	0	F
58	60	59	96	31	31	0	D	140	141	142	64	704	704	0	D
59	0	0	75	31	31	0	D	141	0	0	65	704	704	0	D
60	61	0	20	153	122	0	H	142	143	0	66	704	704	0	D
61	62	0	22	122	122	0	D	143	144	145	67	704	586	85000	E
62	60	63	96	122	122	0	D	144	0	0	68	585	585	0	D
63	0	0	74	122	122	0	D	145	0	0	69	704	118	15000	E
64	69	0	70	0	0	0	D	146	147	0	3	322	154	0	S
65	70	0	73	2	2	0	D	147	14	0	18	154	8	0	C
66	71	0	72	0	0	0	D	148	0	0	94	230	230	0	D
67	68	0	79	12	12	0	D	149	150	0	3	120	68	0	S
68	0	0	80	14	14	0	D	150	27	151	18	60	8	0	C
69	68	0	46	0	0	0	C	151	0	0	94	60	68	0	D
70	68	0	58	2	0	0	C	152	153	0	3	330	162	0	S
71	68	0	52	0	0	0	C	153	46	0	18	162	8	0	C
72	76	0	81	9	9	0	D	154	0	0	94	552	552	0	D
73	79	0	73	18	18	0	D	155	156	0	86	1468	169	0	F
74	78	0	76	0	0	0	D	156	157	0	87	169	169	0	D
75	75	0	79	125	125	0	D	157	159	158	88	168	118	25000	E
76	0	0	82	417	417	0	D	158	162	0	90	168	53	35000	E
77	0	0	60	6	6	0	D	159	0	0	89	115	115	0	T
78	76	0	52	0	0	0	C	160	161	0	93	111	111	0	D
79	76	0	58	18	0	0	C	161	0	0	91	111	111	0	T
80	84	0	81	1	1	0	D	162	0	163	91	53	46	0	R
81	85	0	70	0	0	0	D	163	0	0	92	53	7	0	R
82	86	0	76	0	0	0	D								

FIGURE 9-53. MAIN MODULE HIT MATRIX REPORT - SP3.5 (CONT'D)

```
 YOU WERE STOPPED AT TIME    100.010000
.....ELAPSED TIME IN SECONDS IS.....          51.44
 TOTAL JOBS STARTED=    53061      TOTAL JOBS COMPLETED=    53015      TOTAL JOBS PREEMPTED=       46
 TASK NO        1      WAS PREEMPTED       2 TIMES(MAX)
ATTEMPTED TO RESTART PREEMPTED TASKS    39 TIMES
RESTARTED PREEMPTED TASKS     8TIMES
 END OF LCOM II SIMULATION PROCESSING
```

FIGURE 9-54. STOP OR RECORD MEMORY REPORT - SP3.5

```
*** ERROR 282 MACHINE-DETECTED FAULT CODE 20 = ATTEMPT TO ACCESS MEMORY BEYOND BAR

* * * * * * * * * * * * * * * * * * * * * * * * * S T A R T   T R A C E   B A C K * * * * * * * * * * * * * * * * * * * * * * * * *

  * JERR.E * ENTERED WITH X0 000001  X1 053237  X2 777772  X3 205230  X4 157275  X5 160576  X6 160610  X7 160450  B 774
                A 000000000000  Q 000000000312
          CALLED FROM LOCATION 053236 - OFFSET 0116 FROM LINE    1 IN JOB.ES

  * JOB.ES * ENTERED WITH X0 261050  X1 000761  X2 000005  X3 205230  X4 157275  X5 160441  X6 160450  X7 160420  B 774
                A 263146318631  Q 000000000000  ARG1 000000000001 000000000000  ARG2 000000000006 000000000000
                ARG3 000000000001 000000000000  ARG4 000000000000 263146318632

          CALLED FROM LOCATION 000710 - OFFSET 0120 FROM LINE    1 IN TIME.E

  * TIME.E * ENTERED WITH X0 000000  X1 013552  X2 000005  X3 205230  X4 157275  X5 205176  X6 160420  X7 160360  B 000
                A 000000000000  Q 032712600000
          CALLED FROM LOCATION 013551 - OFFSET 0213 FROM LINE    1 IN MAIN

* * * * * * * * * * * * * * * * * * * * * * * * * E N D   T R A C E   B A C K * * * * * * * * * * * * * * * * * * * * * * * * *

TIME.V =      7166666  EVENT.V =    7  READ.V = 11  WRITE.V =  6

                I/O STATUS
UNIT    MODE      RECORD.V    COLUMN    REPLY
   4    OUTPUT          10      1286
   5    INPUT            1        2         0
   6    OUTPUT         268        0
   7    INPUT           12      792         0
   9    OUTPUT         798        0
  10    INPUT          103       86         0
  11    INPUT            7       86         0
  16    INPUT          185       83         0
```

FIGURE 9-55. ABORT SITUATION PRODUCT

X. DATA DEVELOPMENT METHODOLOGY

A. Introduction

An LCOM data base can be structured in varied detail depending on the level of abstraction of the aircraft maintenance environment being simulated. The environment can be described in extreme detail or simplified to the extent of representing maintenance time on the aircraft as a single task. The manner of representing the maintenance activity depends on the problem, the data availability, and the user's preference. The network completely depends on the problem.

This chapter is primarily included as an aid to new users who may be defining a sizeable data base. Data collection and development problems are emphasized to provide insights to any future large or medium sizes applications. Only the unscheduled maintenance networks are discussed but similar problems and techniques would apply to most networks, e.g., scheduled maintenance.

Basically, tasks described in an unscheduled maintenance network represent a complete set of maintenance actions, i.e., the sequence of events leading to an operationally ready aircraft and to the repair of a removed part. In order to describe these steps, it is necessary to describe who takes the maintenance action, what equipment is needed to perform the action, and how long the action takes. Also, required parts,equipment, manpower, and skills must be specified in order that a maintenance action may draw the appropriate resources for use in performing the task. Broadly speaking, one identifies the subsystem (or Line Replaceable Unit (LRU)), defines the sequence of maintenance actions leading to conditioning of the aircraft (and/or the repair of removed parts), and defines each repair step or task in terms of the resources and the time needed to perform the repair task.

B. Definition and Description of Data Elements

Three data elements will be discussed: the network, the task, and the resource. Actually, the three elements form a hierarchy. A network is made up of tasks and a task is described by the resources and time required to accomplish it.

1. Network

One can think of a maintenance network as an ordering of tasks which occur from the time an aircraft requires maintenance until the aircraft has become operationally ready again and any failed parts are either repaired or have been replaced in inventory by a new one. The term network simply describes a convenient drawing process which allows us to represent on paper the sequence of repair tasks we wish to describe.

Figure 10-1 is a very simple network which illustrates most of the basic features to be incorporated. The circles, or nodes, can be thought of as points in time. For instance, node B is the point in time which follows task 100 and precedes task 101. The lines between nodes can be thought of as tasks which occur during an interval of time. Thus, task 101 begins at time B and ends at time C.

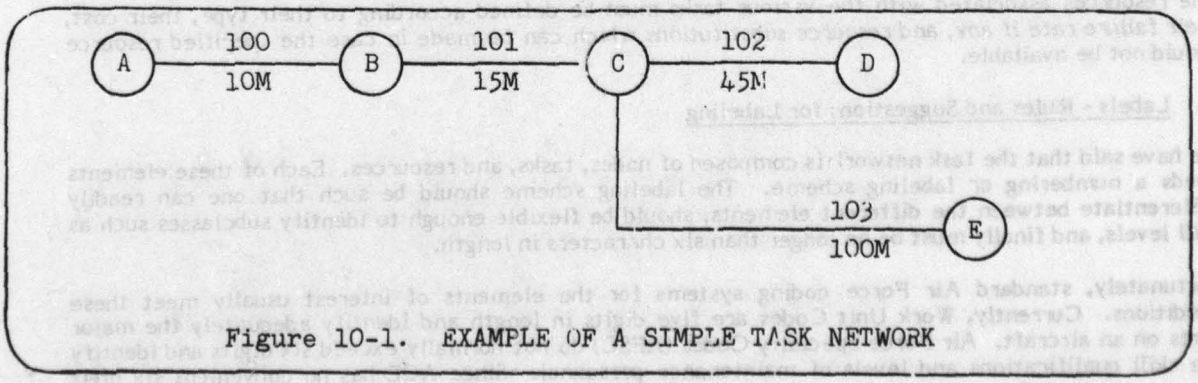


Figure 10-1. EXAMPLE OF A SIMPLE TASK NETWORK

Alternatively, we can say that task 101 directly follows task 100 and precedes 102 and 103, and that it takes 15 minutes. Using the convention of nodes and lines we can also show tasks which proceed independently of each other such as 102 and 103.

In the development of a network, the crucial thing is to identify all the possible ways in which the repair of an aircraft and/or parts might occur, and the order in which they should occur. If the network shows a part being removed, then a replacement logically must occur sometime subsequent to the removal. Just when it occurs may well depend upon the part and its repair policy which must be researched in order to properly draw the network. Also, one must show the disposition of the removed part. Is it repaired in the shop, at the depot, or is it discarded and a new one ordered?

2. Tasks

The second data element, tasks, are the elements from which a network is built. Obviously, the same network can be described in terms of a few very general tasks, or many very specific tasks. For example, one might simply have a task called "repair" to describe all actions performed during the repair of a failed item or one might identify very specific repair steps, such as "loosen six bolts," as separate tasks. In part, the question of how much detail should be represented in defining separate tasks will be answered by either the purpose of the study, the data sources used, or both. However, one should avoid the tendancy to be too detailed in task descriptions. Two to five tasks should be adequate for the usual part repair network; however, complex parts may require more tasks.

During the task network development, a modified version of the Air Force Maintenance Data Collection (MDC) System Action Taken Codes furnishes an adequate list of task descriptions. This list has the virtue of being short and is capable of describing tasks at the level of aggregation which is desired. See Table 10-1. The data comes from the Common Data Extraction Program, one of the LCOM II support programs that analyzes the MDC System tapes.

3. Resources

In order to describe a given task, one needs more than a simple action description. One must also include the resources and expected time required to accomplish the action. The types of resources which are to be specified are man, AGE (Aerospace Ground Equipment), parts and facilities. Each task must be defined in terms of what resources will be used during the performance of that task. For example, a normal task requires manpower of one or more skill classes and grades, perhaps some AGE, and if it is a replacement task, a serviceable part must be available with which to make the replacement. However, some tasks may take no significant resources. For example, an item sent to a depot for repair and returned ten days later takes no significant base manpower or AGE during the ten days but does represent an unavailable part for the ten days. Hence, it is a task resulting from a failure which affects the base inventory of parts for ten days. In general, what resources will be needed to accomplish a task depends entirely upon the action defined and the part under consideration.

The resources associated with the various tasks must be defined according to their type, their cost, their failure rate if any, and resource substitutions which can be made in case the specified resource should not be available.

C. Labels - Rules and Suggestions for Labeling

We have said that the task network is composed of nodes, tasks, and resources. Each of these elements needs a numbering or labeling scheme. The labeling scheme should be such that one can readily differentiate between the different elements, should be flexible enough to identify subclasses such as skill levels, and finally must be no longer than six characters in length.

Fortunately, standard Air Force coding systems for the elements of interest usually meet these conditions. Currently, Work Unit Codes are five digits in length and identify adequately the major parts on an aircraft. Air Force Specialty Codes (AFSC) do not normally exceed six digits and identify the skill qualifications and levels of maintenance personnel. Since AGE has no convenient six digit

TABLE 10-1

LCOM ACTION CODE DEFINITIONS

	LCOM Action Code	Description	Includes MDC
ON EQUIPMENT	V	Operational Check	X Action Taken Codes
	T	Troubleshoot	Y Action Taken Codes excluding 812 How Mal Code, and H Action Taken Codes when an "R" or "M" LCOM Action occurs under same JCN
	R	Unscheduled remove & Replace	R, P, and Q Action Taken Codes* excluding those with How Mal Codes 799, 800, 803, 804, and 805 (includes associated "M" work)
	RT	Scheduled Remove & Replace	R, P, and Q Action Taken Codes* with How Mal Code 803
	M	Repair in place/ minor maintenance	F, G, J, K, L, V, and Z Action Taken Codes
	H	Cannot duplicate malfunction	All H Action Taken Codes, and Y Action Codes with How Mal Code 812 (an "R" or "M" Action under same JCN causes "H" to become "T")
	X	Remove and replace to facilitate other maintenance	All S Action Taken Codes, and R, P, & Q Action Taken Codes* with How Mal Codes 799, 800, 804, and 805
OFF EQUIPMENT	N	Bench checked not reparable this station (NRTS)	D, 1, 2, 3, 4, 5, 6, 7, 8, and 9 Action Taken Codes (includes associated "C" & "D" work)
	K	Bench checked no repair required	B and X Action Taken Codes (includes associated "C" and "D" work)
	W	Bench checked and and repaired	A, F, G, J, K, L, V, and Z Action Taken Codes (Includes associated "C" and "D" work)
	C	Bench checked and repair deferred	C Action Taken Codes which cannot logically be combined with an "N", "K", or "W" action
	D	Disassemble/reassemble	M and N Action Taken Codes** which cannot logically be combined with an "N", "K", or "W" action

* Formula for equating P&Q units to R units $\frac{\text{P units}}{2}$ (rounded up) + $\frac{\text{Q units}}{2}$ (rounded down)

**M and N units counted the same as P and Q units respectively.

code system which covers all major equipment, it may be identified by its five digit work unit code or a special code may be developed.

To distinguish between parts, men and AGE, a special character can be placed in front of the five digit work code. A period could serve to distinguish parts, while another special character, the dollar sign, could serve to identify the AGE. Any special characters available on a computer will serve the same purpose. One must remember, however, that these labels can have no more than six characters including special characters which may be attached for differentiation purposes.

The labeling of nodes is also restricted to six characters. Each two digit Work Unit Code can be associated with an alphabetic character which is used as the first character in the node label whenever a network is being drawn for a part belonging to that two digit Work Unit Code group. The remaining characters are labeled numerically and consecutively. This approach prevents duplicate labels for different nodes.

Task labels or identifications can have up to six characters. If one combines the modified Action Taken Code (Table 10-1) with the Work Unit Code of the part or system which is being acted upon, the task label will describe what is being done to what part. The important concept to remember in developing and assigning labels is that a label must be unique within a group. However, a task could have the same name as a node or resource.

D. Selection Procedure for Critical Parts

One of the constraints that one quickly encounters is the limited number of parts which the model can represent in network form. This limitation occurs because an average of eight tasks are required to describe the maintenance actions for one part. Each task requires an average of four computer words of storage. Thus, 500 parts need approximately 4000 tasks which consume approximately 16,000 words of storage. An attempt to define the maintenance network for all parts of an aircraft could easily exceed the core capacity of a large computer. As a result, a selection procedure is needed to identify the limited number of items which are of interest to the user.

The user will be interested in assessing the impact of operations policies, maintenance policies, supply policies, manning policies, etc., upon the whole support system and its capability to perform its missions. For a meaningful simulation, it is necessary to represent all critical portions of the support system, but not every piece of it. The question is then to determine what portion of the total activity is represented by the selected parts. If these parts are the items which generate most of the maintenance workload and the demand for manpower and spares, then a realistic picture is obtained from the simulation.

In order to identify items which have a high impact upon the support system, one can go to historical data, if available, or look at engineering estimates. These sources should identify which items have high failure rates and consume large quantities of man-hours. These same items are normally reparable and tend to be high cost items. Fortunately, then, the items which have a high impact upon maintenance will also tend to have a high impact upon supply. Other items are certainly significant, but their analysis is not best accomplished in a simulation model.

Another element in the selection procedure is the usage of AGE. It is desirable to include items which require high cost pieces of AGE. These parts tend to be the same as the high cost, high man-hour consuming parts. As an initial selection procedure, one can select historically high man-hour consumption items, or high cost reparable items, or high failure rate items and often end up with similar lists of parts. Such a procedure is not guaranteed to identify the best list of parts which might be selected, however, the advantage of speed and ease make it useful as an initial approach. Later additions or deletions, as the need arises, can be made.

E. Network Development

1. Possible Data Sources

The source of information used in the development of maintenance task networks will depend to a large extent upon the state of the weapon's development. For weapons which are already operational,

many sources can be found. For weapons still in the conceptual stage, reliance will have to be placed upon design data and information from similar weapons. Since the repair steps tend to be similar within various subsystems, it is likely that network development will in reality become a process of refining past developments rather than starting from the beginning.

Several sources are useful in the development and refinement of networks. Contractor furnished data sets forth in detail the tasks necessary to repair a failed item. Most of the data needed to define networks is available from the contractor include estimates of task times and the resources necessary to perform the tasks. However, a good deal of familiarity with the contractors data may be needed to dig out the necessary information since this data is not explicitly developed for network purposes.

A potential problem in using a contractor data source for networks is that it often tends to make the assumption that the failed item is clearly identifiable. Thus, the sequence of tasks which are needed to locate the failed part is often left out. Another problem with contractor data is that its task time and failure rate estimates are often not based upon actual field experience. It is advisable to augment contractor data with information from sources which have direct field experience with the part and its maintenance tasks. Field data may provide improvements upon failure rate estimates, while maintenance personnel who have had experience with actual repair of the same or similar items can provide improved task time estimates. With this type of augmentation, contractor data should prove adequate.

2. Data Generation Procedure - An Example

The following example was developed in order to illustrate some of what has been presented. See Figure 10-2.

The network is relatively simple. The part selected is a pump in the PC 11 hydraulic system. The Work Unit Code (WUC) of the pump is 45128. The system to which the pump belongs is the PC 11 hydraulic system--WUC 45120. According to contractor data, if a pump failure occurs, the first action which must be performed is a troubleshoot action upon the hydraulic system. This is done by the crew chief (43171C) and it takes him 8 minutes. We call the task T45120 since T is the troubleshoot action code (Table 10-1) and 45120 is the system upon which troubleshooting is performed. The report of the failure contained sufficient information for the crew chief to know which system was causing the problem.

Following the troubleshooting task, the pump is removed and replaced by a new pump from supply. This task (R4512B) requires a pump for replacement purposes, a specialist (42152) and takes 45 minutes to perform. Following the pump exchange, the filters are removed and replaced by the same person, requiring a new set of filters and 199 minutes. The filters are assumed to be available. This is task R4512K performed on the filters - WUC 4512K.

The last task done on the aircraft is a functional test of the hydraulic system, 45120. This task is labeled V45120 since V is the Action Code for functional testing. This task requires a 43171C, a 43151C, and 42152; i.e., the crew chief, his helper, and a hydraulic specialist. It takes 317 minutes. In reality, this task is a combination of several tasks such as turning on the aircraft, checking the system, and servicing the aircraft following maintenance. However, it appeared that all actions could be combined into one task without unduly altering the actual events. Generally, this combination can be done whenever the same resources are used to perform sequential tasks. In this case, the times can simply be added together.

Backing up in the network, the task N4512B is that which represents sending the failed pump to the depot and receiving a new one from the depot twelve days later. The twelve day time interval in an estimate of the total pipeline time between base and depot. Other improved estimates can be used. It should be noted that no base resources are assigned to the task. This is because the part is in transit or at the depot for almost all of the time; hence, no base resources are required.

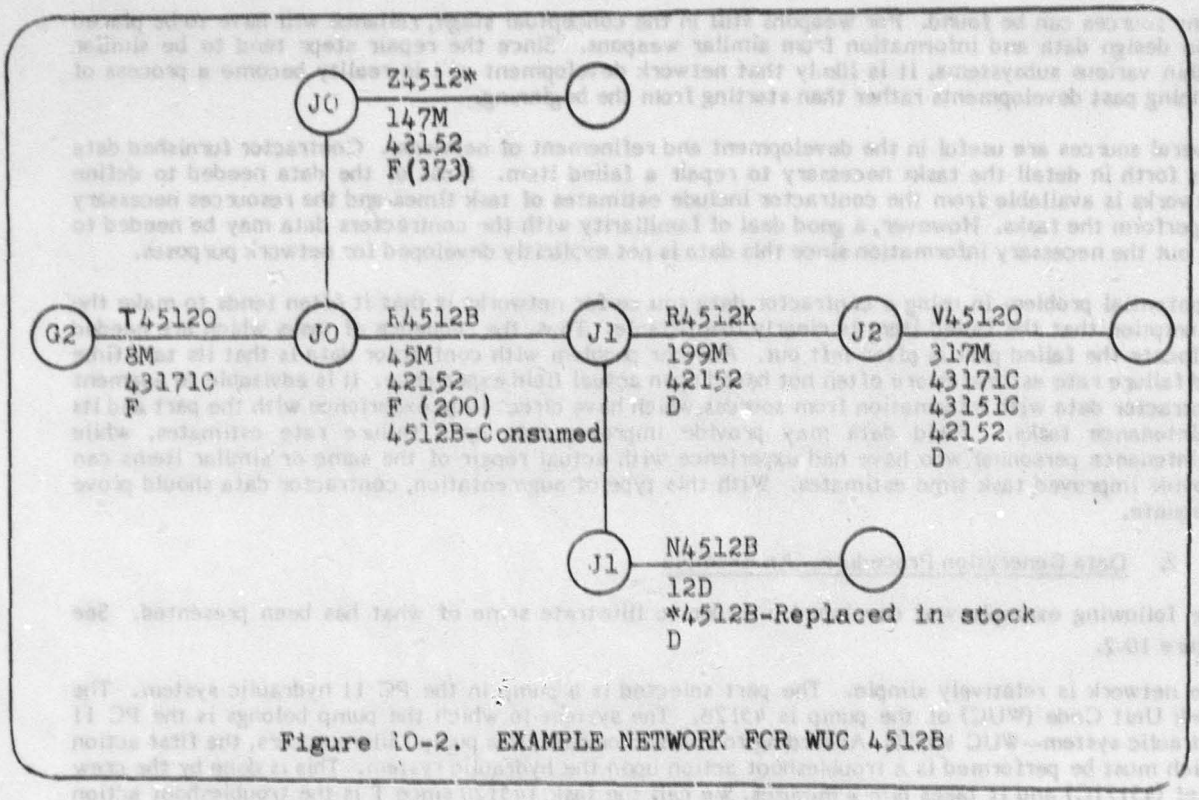


Figure 10-2. EXAMPLE NETWORK FOR WUC 4512B

The final task shown in Figure 10-2, Z4512*, is a special purpose task which has been devised to improve upon the ability of this network to completely represent all base maintenance. In general, the Z task attempts to represent an average amount of maintenance which would be performed on several parts in the system not including the specific part under consideration. This is done for two reasons. First, it holds a place in the network for later additions to the network. Second, in a gross sense it represents the maintenance activity on the aircraft (not shop) which has not been accounted for specifically in the network. The time used for this task is an estimate of the average time for the average parts represented in the system. The resources needed for this average task are a composite of what might be required for repairs on the other parts, but normally does not include lower indenture parts consumptions.

As the network becomes more complete, the need and effect of the Z task is reduced. It is really an interim step which may be surplanted at a later time by the actual tasks which the single average task is intended to represent.

Once the network is established, selection modes may be assigned to the respective tasks. For the example network, the tasks are given either an F, D, or E selection mode. The tasks which are performed only if they lead to a failure are given an F selection mode. The R4512B is mode F since it is controlled by a resource clock with a mean value of 200 flying hours. Also, the preceding task T45120 following the G2 node (the node following the post flight inspection where failures are discovered) must be given mode F. In the example network, all tasks following R4512B receive a D mode since these tasks are to be done if the task is accomplished. For example, following the removal and replacement of the pump, the filters are removed and replaced (R4512K) and the pump is sent to the depot for repairs. These tasks follow R4512B and are all three done.

Note that the pump (4512B) is consumed by task R4512B and replaced in stock by task N4512B. The other components of the system (45120) are not explicitly simulated and the workload they generate for personnel is included in task Z4512*. The failure rates for these other components are too low to include them individually. Finally, this entire branch of the network is assigned mode F since it is controlled by the "clock" value which has a mean value of 373 flying hours. This 373 hours does represent an average of the failure rates of the "other components."

After the network is developed, the associated data is transcribed onto the appropriate input forms.

3. Some Problems In Network Development

One of the more vexing problems identified during initial network development may be the incompleteness of the data. As previously stated, some data sources assume the failure has been identified. Thus a substantial number of tasks may be omitted from the description. You can correct this problem by having people who are familiar with the aircraft develop the network. They could then apply their knowledge and add troubleshooting and other tasks where they felt there was a requirement which was not included. Most systems need this type of augmentation.

A final problem is relating parts to the proper systems. Given a part failure, one usually checks the system, subsystem, or set to which it belongs in order to identify the failed item. In some cases, however, the work unit code manual did not place the part in its proper functional category. For example, a part might belong to a grouping of parts which would be functionally related but spread all over the aircraft. However, the Work Unit Code system should be used since the maintenance data is readily available in this form.

4. Follow-on Network Development Efforts

The network shown in Figure 10-3 is typical of networks developed for a Fire Control System. An explanation follows.

The W task shown between nodes 1 and 2 designates all unscheduled on-equipment maintenance actions. The F indicates that this section of the network will not be entered unless there is a failure or a requirement for on-equipment maintenance. The mean time between maintenance actions is 20. Listed also is the maintenance time manpower required to accomplish the action.

The E task between nodes 2 and 3 indicates the quantity of off-equipment actions pertaining to the part designated by WUC 74110 or:

$$\frac{\text{Total 74110 off-equip action}}{\text{Total on-equip actions}}$$

The E task shown between nodes 2 and 4 relates to the quantity of 74110 modules (2nd indenture recoverables) that are fault isolated and removed from the aircraft without removing the parent assembly. It will be noted that if the part is removed on-aircraft the removal of the next higher assembly is precluded by the designation of an E task (mutually exclusive).

The E task between nodes 3 and 11 relates to the quantity of items that are removed and bench checked serviceable or removed with no repair required. Two conditions can result:

a. These are condidered to be short turnaround items that do not create a demand on supply and are not included in the repair cycle time as computed by the model.

b. Bench checked serviceable and returned to supply without maintenance repair action after serviceable part from supply is placed on aircraft. This does not create a demand on supply.

The E task (a dummy task used for task selection only) between nodes 3 and 5 indicates the quantity of parts that are time failures and on which repair action is required and therefore creates a supply demand as indicated in the Q task shown between nodes 5 and 12.

The T task shown between 5 and 6 indicates a fault isolation or bench check, off-equipment, on which a repair action is required. Times and resources were not included on this task in initial data packages but were in subsequent data in order to reflect the time on items that are NRTS or condemned. This task would generate the next indenture part.

The N task shown between nodes 6 and 13 indicates the quantity of items on which repair is required that are processed NRTS or are condemned.

The F task shown between nodes 6 and 7 indicates the quantity of the part repaired on base. Resources and times would be shown on all tasks as appropriate. Some times are reflected on the figure.

The A factor shown between nodes 7 and 8 indicates the quantity of WUC 7411A parts that are found to be involved in the repair of WUC 74110 after it is taken into the shop, as opposed to on-equipment fault isolation and removal.

The A factor shown between nodes 4 and 8 indicates the quantity of WUC 7411A parts that are fault isolated and removed on-equipment.

The tasks shown for WUC 74110 are duplicates of the tasks shown for off-equipment repair of WUC 74110 and a similar explanation applies, with the exception of the task shown between 10 and 16 which relates to a repair processing time as opposed to the actual time which is shown under the F task.

5. Additional Applications and Network Techniques

Experience gained during network development for part application indicates that it is feasible to consider the application of LCOM to new systems and apply the factor and resource requirements prior to the availability of actual usage data. However, additional work and development of predictive techniques are required.

F. Some Special Problems

1. The Same Part Used in More than One Location

Although this does not impose a problem in network development, it does require special consideration in establishing a stock level for the items and assuring that the model makes the correct draws from the supply account and returns the correct item to the account after repair has been accomplished. There are a variety of methods by which this can be accomplished, e.g., (1) the stock level can be divided between each application and use of the item; or, (2) all requirements can be aggregated under a single network branch with the A factor between a W and Q/Y task reflecting the total off-equipment activity for the items.

However, neither of the above truly represents the actual condition. If (1) is followed, the true stock level required to support all uses is not represented. If (2) is followed, failures of the item are equally spaced as if it were a single item and the possibility of queuing or simultaneous failures is eliminated.

The total stock level is aggregated under a single WUC identification and this WUC becomes a substitute resource for all other applications of the same item. To assure the return of a repaired item to a single stock level identification the network nodes should be numbered to lead the supply demand and off-equipment repair effort to a single node prior to the consume and generate tasks. This node is usually the first time the item appears in WUC sequence.

2. Work Unit Codes Representing More Than One Item - Items Are Not Interchangeable

This does not impose a problem in network development; however, if it is desired to include repair actions and supply demands specifically on these items, it is necessary to consider them as separate items in the model.

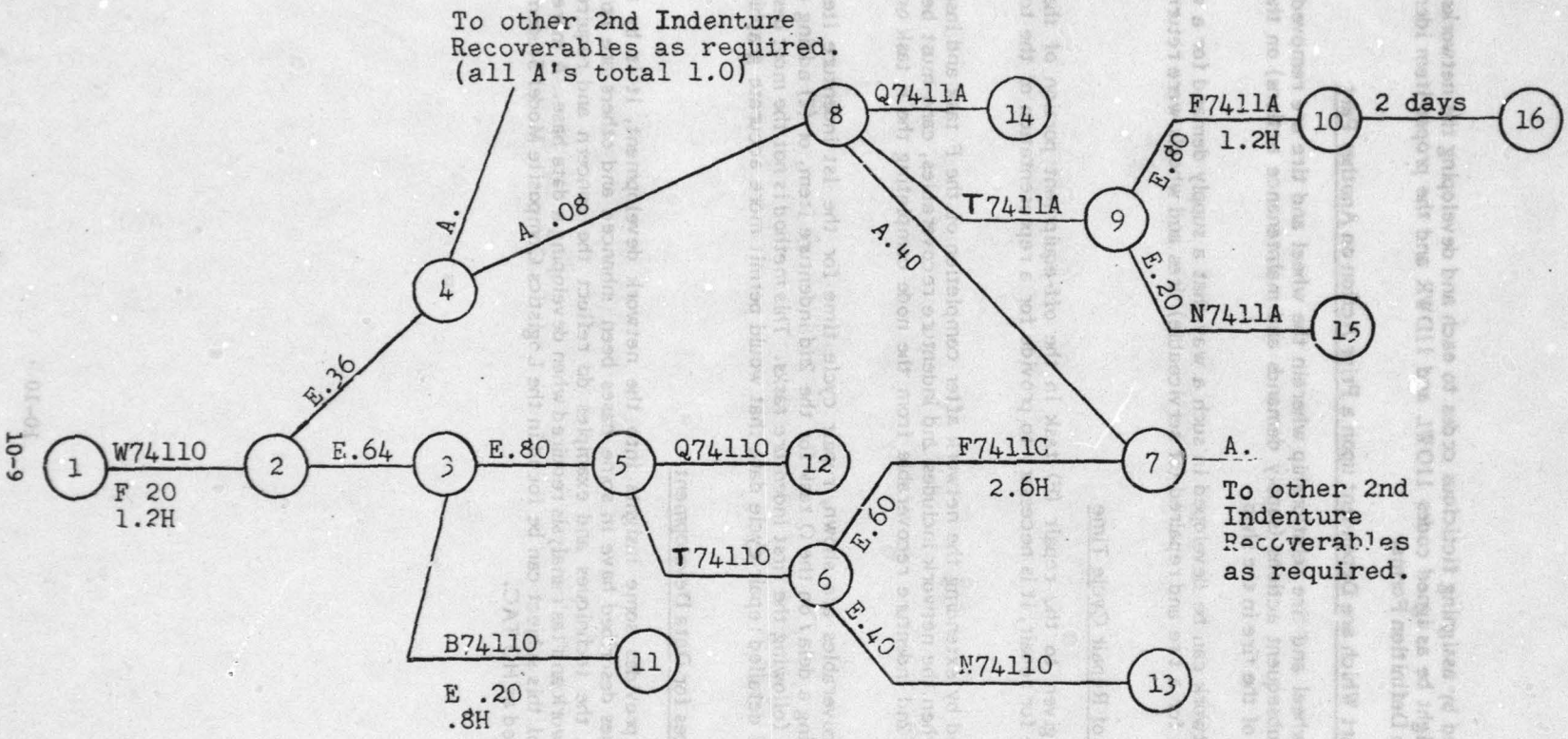


Figure 10-3 FIRE CONTROL SYSTEM NETWORK

This can be accomplished by assigning ficticious codes to each and developing the networks for each. For example: 111DW might be assigned codes 11DWL and 11DWR and the proper item identification made in LCOM Resource Definition Forms.

3. Actions on a Part Which are Dependent upon a Prior Action on Another Part

A case in point is the wheel and tire relationship wherein the wheel and tire are removed as a unit from the aircraft and subsequent actions (supply demands and maintenance actions) on the tire are dependent upon removal of the tire in the shop.

In this instance, the network can be developed in such a way that a supply demand for a wheel also generates a requirement for a tire and repaired (or serviceable) tires and wheels were returned to the supply account.

4. Representation of Repair Cycle Time

Inasmuch as the time given to the repair (F) task in the off-equipment portion of the network represents only the time for repair, it is necessary to provide for a representation of the total repair cycle time.

This can be accomplished by extending the network after completion of the F task and inserting the total time. However, when the network includes 2nd indenture recoverables, care must be taken to direct the path for the 2nd indenture recoverable from the node completing the F task on the first indenture item.

When 2nd indenture recoverables are shown, repair cycle time for the 1st indenture item can be included by (1) establishing a delay on the Q task for the 2nd indenture item, or (2) adding an overall delay task fromthe node following the first indenture tasks. This method is not the most desirable but is used in the absence of detailed repair cycle data that would permit more accurate graphing of this activity.

G. Additional References for Data Development

Although this chapter provides some insights into the network development, it is by no means complete. The techniques described have in some cases been enhanced and others are no longer in general use. However, the techniques and examples do reflect the concern and requirement for completeness of the network and task analysis required when developing a data base. A more thorough and detailed discussion of this subject can be found in the Logistics Composite Model Student Training Text, July 1977, developed at HQ TAC.

XI. GENERAL OPERATING AND STUDY PROCEDURES

A. Operating Procedures

There are a number of steps which must be taken to complete an LCOM II run from beginning to end. Although it is possible to set up an execution sequence which would accomplish all steps in one series of runs, it would be impractical. It is recommended that the following initial steps be followed.

1. Compilation and Assembly

This consists of translating four modules (Input, Main, Restart, and Post Processor) from their source language to machine object code. The resulting object code and the SIMSCRIPT II execution routines must be stored on files, henceforth to be referred to as object files. This only needs to be accomplished once and thereafter only if the program is changed. AFMSMET makes periodic releases of the object files on magnetic tape to Air Force users of LCOM II, therefore only the storage step is required by these users. Appendix A describes this object release tape and the specific instructions for loading these files to permanent system files.

2. Data Storage

The data records resulting from the input forms may be considerable in number. Since card read-in is slow at best and hazardous at worst, it is recommended that the data records also be put on a file or tape, in card-image form. This can generally be accomplished with local system software or through the use of the LCOM II support program XFER. Changes within this data base can then be made through system update capabilities or through the use of the XFER program.

3. Program Executions

The execution sequence begins with the Input Module run. After all data is corrected and the Input Module creates both an initialization and an exogenous file, the Main Module can be executed. The Post Processor Module and individual post processors can then be executed. The Restart Module would only be used where necessary (reference Chapter IV, para B31). Appendix A contains the recommended job control language (JCL) job streams for the Honeywell, IBM, and CDC implementations. Local system differences may require changes to this JCL. This appendix also includes a sample problem, its run results, and all necessary information to check out an implementation of LCOM II. In addition, the file structure and interfaces between the modules and post processor are described.

Finally, each of the modules and post processors require one specification (SPEC) record to be read from the card reader of equivalent file. This SPEC card is a control record that contains the user defined input/output file requirements and assignments. It also permits the selection of several run options. See Chapter IV for details of this SPEC card.

B. Form Preparation and Set-up

1. Sequence Restrictions

Every form is numbered according to its use, as reflected in Table 3-1, and are all read by the Input Module. Form 10 must be the first form entered, Form 13 must precede Form 12 if Form 12A's are used, and Forms 17, 21, 22, and 23 must follow in sequential order. No other ordering restriction exists.

2. Preferred Sequence

If the following preferred sequence is used, a special feature of the Input Module provides that not only will the normal diagnostic messages be grouped at the end of the input processing listing, but additional diagnostics will be placed within the listing, usually right after the record in error. This does result in multiple diagnostic references to the same error, but is extremely useful. The preferred sequence is: Forms 10, 13, 12, 11, 14, 15, 16, 18, 17, 21, 22, 23 and 20.

C. Deck Set-up Pointers

1. Input Module

Remember that in your input deck:

Form 18 need not be included in the data deck if the default values are acceptable.

If empirical distributions are not used, Form 15 need not be included.

If no resources defined on Form 13 are to be on a shift, Form 16 need not be included. This is the case when no shifts are required.

If failure mechanisms (failure parameters on Form 13) are not used, Form 14 need not be included. A warning diagnostic will be given in this case.

The minimum deck necessary to produce an initialization is Forms 10, 13, 12, 11, 17 and 21.

Form 20s are normally run separately since they are used by the independent sortie generator to produce the exogenous tape. However, if empirical distributions are used on Form 20, Form 15 must be read with Form 20.

The first record in each group of forms is considered a header record and all data on the record except for the form number itself is ignored. All other records of the same form number will then follow this record. Spacing to the top of a new page is automatic for each group. The very last data card must have a 99 in Columns 2 and 3 to trigger final input module processing and production of the initialization file.

Column 1 may be used to space as desired on any data card. Refer to Chapter III, Section C2. This feature permits the input processing printout to be more user controlled.

2. Main Module

Since the "Change Card" method gives the user quite a bit of flexibility to change selected parameters without a rerun of the Input Module, the following pointers are given to facilitate use of this method. Refer to Chapter VII for details about the Change Cards.

Always consider making minor changes to the data base by this method particularly in fine tuning a run or series of runs instead of rerunning the Input Module. When enough changes are made here to warrant cleaning up the Input Module data deck and rerunning it, then take the applicable change cards out and make a corresponding change to the input deck. Recheck the initialization to ensure that the changes made were processed correctly. Examples of Change Cards for which this technique is applicable are: AUTH, CKCNG, Form 18 Variables, RCYC, RFREQ, SAUTH, TKCNG, etc.

To properly sequence several different reports to be printed at the same time, modify the decimal part of the floating time field slightly. For example, request the first report at 6.0001, the second at 6.0002, the third at 6.0003, etc. This effectively prints all the reports at time 6.00, but in the sequence desired.

Make effective use of the available SWICHes. Control all SWICH settings through the change card file.

Modify the performance summary report frequency (RFREQ) and cycle (RCYC) here, if required, even though they were originally preselected on Form 10.

Make an initial unconstrained run against the data base (initialization and exogenous) by using the AUTHA card with a multiplication factor of between 10.0 and 20.0. What this effectively does is operates the simulation with "unlimited resources" and will indicate any gross problems in the package. Error indications will generally show up in the reports.

NOTE: This AUTHA card multiplies the resource authorization by the input factor, so if any resource is authorized at zero, it must first be increased to one or more with an AUTH card. Place the AUTHA card just before the STOP card.

Change the random seeds with the ISEED change card for complementary runs leaving all other factors constant.

3. Post Processor Module and Post Processors

If any post processor output is required, the data must first be requested in the Main Module Change Card file, then subsequently the processing of it must be requested on the Transaction Decoders SPEC card. This type of implementation precludes the generation of large data files which require the use of extra tapes during processing and is an aid to those users who do not require the additional data.

On post processors with start and stop times required on the SPEC card, first verify that the data requested from the Main Module was output for that period of time (or more). Examples of this are GRAPH and MATRIX.

Reference Chapter V for further details on the Post Processor Module.

D. Data Analysis Techniques

Prior to processing a new data base through the Input Module, a plot of the networks should be thoroughly reviewed. See Figure 9-1 for example plot. This data verification is a valuable step in data development and should be considered a must. Obscure network logic errors often become readily apparent when networks plots are reviewed. This plotting is generally accomplished by hand in the development phase but changes rarely get made to these hand drawn plots. Use of a mechanized plotting system is recommended. A system is currently available for Honeywell computer installations that have a CALCOMP Plotter.

The output from the Input and Main Module should be reviewed in detail to ensure validity and logical results. Just because an initialization tape is produced, there is no guarantee the data is error free. A misplaced decimal can change a half hour task into a 3 minute or 18 second job. It is obvious what a crew size error would do to man-hour consumption.

Every warning and informational message from the Input Module should be checked. The Main Module outputs should be used to their maximum to insure that manning is based upon logical and accurate results. Aircraft turnaround time, man-hours used, percent sortie accomplishment are just a few of the key statistics that should be used to insure logical processing and modeling techniques.

Other Main Module reports are very helpful. The Hit Matrix should be reviewed in detail to insure the networks are being entered the expected number of times. BOSTATs are essential to insure individual work centers are not creating bottlenecks and back orders are not accumulating.

The work center manpower matrix indicates when the resources are demanded and where manpower is being backordered. It also indicates how effectively the number of crews in a particular shift are being used.

The initial Main Module unconstrained run should reflect 100% flying. The reason(s) why 100% flying was not reached must be determined. The QSTAT reports and Realized Flying Schedule data should provide this answer. Any corrections necessary must be made prior to attempting constrained runs. An idea of what to expect in man-hours should be compared with the results of the simulation. The output from the Common Data Extraction Program (CDEP) and other support programs, such as, the Expected Value program may provide some type of "bench mark" to aid in interpreting results.

All of the above should be accomplished prior to attempting constrained runs. These preliminary analysis techniques help ensure that unexplained problems won't be encountered during the resource constraining process and therefore that model reaction is to the constraining process alone rather than to other undetected problems.

The constrained runs analysis of the aircraft configuration report, QSTAT will aid in determining if there are any unusual conditions occurring within the simulations with respect to configuration management. These QSTAT reports are also helpful when analyzing unconstrained runs.

The Realized Flying Schedule data and Mission Post Processor results should be used to verify that sorties lost are due to maintenance non-delivery and not because of poor scheduling of the flying program. Sorties can be scheduled in such a manner that they have no possibility of being accomplished.

The analysis and data verification techniques that have been described are by no means complete but can serve as a guide toward better simulation analysis.

Appendix A

Standard System Release

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APPENDIX A

STANDARD SYSTEM RELEASE

I. PURPOSE

To provide a complete description of the standard system release tape, implementation procedures, job control language, and implementation test run results.

II. SCOPE

The remainder of this section will include the description of the appropriate Honeywell, CDC, or IBM implementation release. The first line printed on all runs will indicate the computer (HIS, CDC, or IBM) and the LCOM II version number. This version number will of the form "X.Y.Z", where for this release X will always be 3 and Y will always be 5. The .Z is for internal AFMSMET use and may be blank or contain a number from 1 to 9. The .Z is to ensure corrections between releases can be tracked for debugging purposes.

III. CAUTION

With each new system release, it will be necessary to load and check out the entire system, i.e., execute all runs. Data interfaces between the runs will not always be compatible across different versions.

IV. STANDARD SYSTEMS RELEASE (HONEYWELL)

Version 3.5E, dated 12 October 1979 is the systems release herein described.

A. Systems Release Tape

The seven track tape produced for the LCOM II Systems Release contains all the necessary program and data files for system implementation and initial check out with sample Problem #3.5. In the following write-up, all names for PRMFL's and/or tapes are recommended names, used for consistency of description. PRMFL sizes given are minimum sizes required for the initial checkout.

B. Release Tape File Description.

File #	Description	PRMFL Name	PRMFL Size (LLINK)
1	Simulation Module Binaries (production version)	MAINCSTR	320
2	Simulation Module Binaries (debug version)	MAINDBUG	366
3	Decoder Binaries	DCDRCSTR	47
4	Parts Post Processor Sort Binaries	PRTSSORT	1
5	Parts Post Processor Binaries	PRTSCSTR	16
6	Manpower Matrix P.P. Sort Binaries	MTRXSORT	1
7	Manpower Matrix P.P. Binaries	MTRXCSTR	82
8	Graph Post Processor Binaries	GRPHCSTR	20
9	Display Post Processor Binaries	DSPLCSTR	12
10	Mission Post Processor Binaries	MSNCSTR	59
11	Support Equipment Sort Binaries	SEQSORT	1
12	Support Equipment PP Binaries	SEQCSTR	20
13	Sample Problem #3.5	SAMPPROB	21
14	Change Card File (Unconstrained Run)	CHNG.UNC	5
15	Change Card File (Constrained Run)	CHNG.CON	5
16	Restart Program Binaries	RESTCSTR	3
17	Input Module HSTAR File (Overlay Binaries)	INPTHSTR	156R

C. Additional PRMFL's Needed to Make Full Systems Test.

File Name	Description	Size	Type Data
EXOG.60D	60 Day Exogenous File	92	BCD
INIT. 3.5	Sample Problem Initialization File	12	BIN
GRPH.OUT	Graph Data Produced by SIMRUN/DECODER	14	BIN
PRTSDICT	Parts Dictionary Produced by SIMRUN/DECODER	1	BIN
MTRXDICT	MTRX Dictionary Produced by SIMRUN/DECODER	1	BIN
DSPL.OUT	Display Data Produced by SIMRUN/DECODER	8	BIN

D. Additional PRMFL's/Tapes Required.

Name	Description	Type Data
U.SIMOUT	Integrated SIMRUN Unconstrained P.P. output	BIN
C.SIMOUT	Integrated SIMRUN constrained P.P. output	BIN
I.SIMOUT	Initialization Data for SIMRUN	BCD
LCOMDUMP	Dump/Restart File (must be a tape)	BIN
PRTS.BCD	Output of DECODER for PARTS SORT	BCD
PRTS.OUT	PRTS.BCD File Sorted	BCD
MTRX.BCD	Output of DECODER for MTRX SORT	BCD
MTRX.OUT	MTRX.BCD File Sorted	BCD
RFS.DATA	Realized Flying Schedule output from DECODER	BCD
SEQ.DATA	Support Equipment Date output from DECODER	BCD
SEQ.OUT	SEQ.DATA File sorted	BCD

E. Run Control Cards.

1. Job control language (Control Cards) necessary to copy the LCOM II system release tape to PRMFLs and conduct test run are described below and are included in table A-1. Figure A-1 contains charts showing the interfaces between runs 3 thru 11. File/Tape names within these listings and charts make reference to the same file names specified in para B, C, and D above.

Run #	Description
1	Utility Program to copy 17 LCOM II system PRMFLs to the Systems Release tape.
2	Utility Program to copy 17 tape files to PRMFL's.
3	Input Module Run of provided Sample Problem.
4	Main SIMRUN (Unconstrained) using Data from Run 3.
4R	Main SIMRUN Restart (from memory dumps).
5	Decoder Run using data from Run 4.
6	Parts Post processor run using data from Run 5.
8	Graph Post processor run using data from Run 5.
7	Manpower Matrix Post processor run using data from Run 5.
9	Display Post Processor Run using data from Run 5.
10	Mission Post Processor Run using data from Run 5.
11	Support Equipment Post Processor Run using data from Run 5.

2. Note: The Input Module Run, Run #3, is processing this test case's Initialization Process and Sortie Generation Process together. However, with large data bases these processes are normally run separately using appropriate null files. There is an extra PRMFL and tape card on the Run #4 JCL after the ENDJOB card. If these are substituted for the equivalent PRMFL 11 and tape 04 cards in the run, the constrained sample problem can be executed. By using the C.SIMOUT tape as input on unit 1 of run 5, runs 5, 6, 7, 8, 9, 10, and 11 can then follow the SIMRUN as before. Also, there are additional exchange cards to make the SIMRUN take memory dump checkpoints for restart purposes. Substitutions to satisfy your own computer system's requirements may also be required.

3. Caution: All jobs submitted thru CARDIN require the use of the STRIP option, i.e. no sequence numbers or data can be in columns 73-80.

F. Description of Test Run Results (for checkout purposes)

1. Run #1 - System copy to tape - Performed by AFMSMET only.

2. Run #2 - UTILITY (Tape to PRMFL) - Users initial run. See Figure A-2 for UTILITY copy results.

3. Run #3 - Input Module.

a. Legal warning and information messages will be found throughout the listing. The message # and quantity found are as follows (#/Qty); 41/1, 144/7, 140/1, 20/1, 67/1, 16/1 , 17/1, 24/1 (NONE), 36/1 (NONE), 11/1 (NONE), 96/1 (7 entries), 97/1 (NONE), 79/1 (NONE), 80/1 (NONE), 4/1 (1 entry), 146/1 (NONE), 147/1 (NONE), 117/1 (NONE), 31/1 (1 entry), and 53/1. Also, with SPEC card option INFO=3, the node range report (MSG 17) will be printed in full.

b. Total sorties generated, by mission type (report):

MSNAM	NO MSN	NO SORT	FLY HRS
PREFLT	60	60	0.0
RECON	420	600	479.999
INTRD1	120	240	363.315
CLSPT1	60	180	137.919
CLSPT2	60	240	346.120
INTRD2	60	120	183.858
INTRD3	60	60	60.0
FERRY1	60	60	119.923
FERRY2	60	120	232.238

c. Input Data Summary (report):

Qty	Descriptor
23	Resources
96	Task Names
130	Node Names
163	Control Table Entries
11	Failure Clocks
9	Mission Entry Points (IETB)
3	Resources Entering Network (NACO)
6	Total # of Configurations Defined (All A/C) (NCRS)
9	Search Patterns (NSRPT)
13	Next Higher Failures (NNHF)
70	Task Resource Requirements (TRR)
9	Unique Groups of Clock Decrements (NOCL)
1	Unique Pieces of Internal Equipment (EQUIP)
2	Internal Equipment Groups (ILIST)
2	Triggering Events (NTEVT.DV)
9	Operations Headings on Form 10
3	Aircraft Headings on Form 10
10	Personnel Headings on Form 10
10	Part Headings on Form 10
2	AGE Headings on Form 10

d. To ensure full preparation of an initialization file, two messages must follow the printing of the dictionaries. These messages are as follows and may be followed by a printout of the entire initialization file data and an additional message "LEGITIMATE END MARKER READ".

. MAIN MODEL INIT FILE IS TO BE PRODUCED.
. LEGITIMATE END MARKER WRITTEN

4. Run #4 - Main Module Run (Unconstrained):

This new sample problem #3.5 does not provide a fully unconstrained run. The pre-sortie time line for internal reconfigurations requires adjustment to permit an unconstrained 100% flying support. It is expected that future versions of this sample problem will again produce truly unconstrained run results.

a. Unconstrained Run

(1) From the Level II day 10-60 Performance Summary Report, the following selected statistics/total values are given:

#	Statistics	Value
3	Percent accomplished	100.00
8	Percent accomplished	99.48
T4	No. of Attritions	2.00
T5	No. of RAM Repairs	2.00
23	Avg No. of Sorties / A/C / Day	1.33
24	Flying Hours	1603.63
33	No. of men demanded	32235.00
40	Simulated MH Per Flying Hr	11.67
44	No. of reparables generated	6544.00
57	No. of units demanded	6715.00
75	No. of units demanded	1069.00

(2) From the end of run Stop (or Memory Saved) Report at time 100.01; total jobs started = 57050, jobs completed = 57050, and jobs preempted = 0.

b. Constrained Run

(1) From the Level II day 10-60 Performance Summary Report, the following selected statistics/total values are given:

#	Statistics	Value
3	Percent accomplished	90.92
8	Percent accomplished	89.17
T4	No. of Attritions	4.00
T5	No. of RAM repairs	1.00
23	Avg No. of Sorties/ A/C / Day	1.25
24	Flying Hours	1417.26
33	No. of men demanded	29548.00
40	Simulated MH Per Flying Hour	12.32
44	No. of reparables generated	6178.00
57	No. of units demanded	6232.00
62	No. of cannibalizations	2.00
75	No. of units demanded	984.00

(2) From the end of run Stop (or Memory Saved) Report at time 100.01; total jobs started = 53061, jobs completed = 53015, and jobs preempted = 46

5. Run #5 Decoder Run (Unconstrained): A two page report is printed as shown in Figure A-3. For runs 5-10, no constrained run results will be given.

6. Run #6 Parts Sort and Parts Post Processor (Unconstrained).

a. Parts Sort Records Input = 11773, Records output = 11773.

b. See Figure A-4 for run results.

7. Run #7 GRAPH POST Processor. (Unconstrained)

a. See Figure A-5 for statistic value printouts.

b. See Figure A-6 for Histogram of post sortie A/C turnaround times.

c. See Figure A-7 for graph of Stat 22 (Avg AC Post-Sortie Time (Hrs).

8. Run #8 Matrix Sort and Matrix Post Processor (Unconstrained).

a. MTRX SORT - Records Input = 93070. Records Output = 93070.

b. See Figure A-8 for one set of matrices (two parts) printed in the run.

9. Run #9 Display Post Processor (Uncon). See Figure A-9 for the first full display of each aircraft (Day 0 and Day 16).

10. Run #10 Mission Post Processor (Uncon). See Figure A-10 for the final Level 3 Mission Success Statistics Summary Report.

11. Run #11 Support Equipment Post Processor (Uncon). See Figures A-11 and A-12 for the model and actual on-equipment demands for the resource called truck in the sample problem.

G. SIMSCRIPT II Systems Release

All installations using LCOM II are responsible for obtaining their own SIMSCRIPT II.5 compiler maintenance. AFMSMET has taken extreme care in attempting to provide an LCOM II model that would run on the Final Air Force release #12. However, latent errors found in release #12 make a subsequent release under a GSA maintenance contract a preferable compiler for use with the LCOM II system. AFMSMET can provide absolute files (HSTARs) to those Air Force installations where there is no compiler maintenance contract. However, the user is responsible for ensuring that the GCOS software at his computer installation is compatible with the standard GCOS software release in use by the CREATE system at Wright-Patterson Air Force Base, Ohio. Any computer system software differences that prevent the SIMSCRIPT II execution library from functioning will preclude AFMSMET's support to such installations.

H. System Improvements

LCOM II Version 3.5E only enhances its prodecessor Version 3.5. The significant differences include the addition of the Support Equipment Post Processor, two new PSR statistics, and a fix to the cannibalization feature in the Main module to better handle multiple backordered demands for the same part. The difference between Version 3.5E and Version 2.0 are as follows:

1. System Standardization

The LCOM II system has been standardized across four computers upon which it has been implemented. These computers are the Honeywell 600/6000, CDC 6600/7600, CDC 6600/7600 with extended core storage (ECS) and the ITEL AS/5 (IBM S360 compatible).

This standardization involves the following:

a. Input Module - PREAMBLE is different on all computers - remainder of source code is identical.

b. Main Module - PREAMBLE is different on all computers - remainder of source code is identical except for the Dump/Restart capability on Honeywell. However, the PREAMBLEs for the CDC and CDC with ECS are identical except for the few lines of code necessary to handle the ECS operations..

c. Post Processor Module - all programs are identical on all computers, both the PREAMBLEs and sources.

2. System Efficiency and memory requirements

The Main Module has been improved in both run time efficiency and memory requirements over that required for Version 2.0. A run time savings (per run) of 20% or more and a memory savings of approximately 8K has been obtained. The run time saving is dependent upon which computer is being used and also on the data base construction. However it should be no less than 20%. This savings comes primarily from the elimination of a detailed programmer debug feature that in most cases is no longer needed due to the stability of LCOM II over the past year and during Version 3.5 testing.

Both a PRODUCTION (streamlined) and DEBUG version are being provided in this release so users will have the Debug version as backup.

3. User Documentation

This user reference guide is entirely compatible with Version 3.5E. Reference to all previous LCOM I and LCOM II user documentation should be discontinued. Also, the improved LCOM II system terminology will help avoid future conflicts in references to the software and data bases.

4. System Compatability

Users of Version 2.0 will have full upward compatability of their data bases except that general substitution must be indicated in the "C" column Form 12 to activate the general substitutions specified on the Form 13's. All new capabilities, and features are user selectable or automatic, requiring either no or some additional data.

5. New Capabilities and Features

a. Generalized Resource Substitution for use with a POMO (AFR 66-5) type organizational structure.

b. Task specific Resource Substitution for use with POMO (AFR 66-5) also.

c. Integration of the PRE-Matrix Program into the DECODER.

d. User control of spare aircraft assignment.

e. Time controlled activity processing, i.e., the ability to cancel an activity not started.

f. Making the Form 17 PRE and POST sortie/activity configuration fields accept a blank (don't change configuration policy).

g. Task substitution on a calendar bases.

h. Ability to change the A, E, and G probabilities during simulation.

i. Multiple HIT MATRIX reports.

j. User external control of AIR ABORTS and their resultant network processing and aircraft configuration.

k. Extra edits on Form 21.

l. Many CHANGE cards can now be used at simulation time greater than zero.

m. Special plugged aircraft logic prior to mission cancellation.

n. User selected aircraft tracking with the DISPLAY post processor.

o. An expanded NODE usage report with many additional data edits and network development aids.

p. Additional cannibalization task edits.

q. Improved user information of the aircraft assignment process with an expanded message 510 in the main module.

r. A full pass thru the CHANGE cards prior to an abort.

s. Elimination/automation of some CHANGE cards.

t. Addition of the U selection mode.

u. Aircraft Displays now print the aircraft tail numbers.

v. Correction of the exponential distribution's use of the threshold constant.

w. Addition of several new reports. (Node Usage Report Part II, Circular Substitution, Resource Combination Sets, and the Aircraft Tail Number Identity Dictionary.)

x. Addition of a new post processor - the Support Equipment Post Processor.

6. Minor Enhancements and Problem Corrections

a. Many new edits associated with the above features have been added.

b. Report 78-5 has marking along the edge of the page to indicate the differences (additions/deletions/corrections) between it and Report 78-1.

c. The cannibalization feature in the Main Module has been modified to take care of multiple backordered demands for the same part on the same AC. Version 3.5 would go to end of network if a demand for a part on an AC occurred and a demand for that part had already been backordered. Of course, cannibalization still cannot occur until all demands except for one for a single part have been satisfied by means other than cannibalization.

I. Error Corrections (from previous versions). - Included in above.

J. Known Errors - Reported with release tape letter.

Table A-1 Honeywell Release 3.5E Runs - JCL

```
$       IDENT           WP1355,MSMET  SYS REL RUN 2
$       NOTE            *** UTILITY JCL TO COPY 16 TAPE FILES TO DISK ***
$       NOTE            ***         FILE NAME IS SR.RUN2                ***
$       USERID          LCOM.II$XXXXXX
$       UTILITY
$       QUTIL           EOF/ALL
$       FUTIL           TP,AA,COPY/1F/,SKIP/1F/,HOLD/TP/
$       FUTIL           TP,AE,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AF,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AG,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AH,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AI,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AJ,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AK,COPY/1F/,HOLD/TP/
$       FUTIL           TP,AL,COPY/1F/,HOLD/TP/
$       FUTIL           TP,SS,COPY/1F/,HOLD/TP/
$       FUTIL           TP,SE,COPY/1F/,HOLD/TP/
$       FUTIL           TP,SP,COPY/1F/,HOLD/TP/
$       FUTIL           TP,CU,COPY/1F/,HOLD/TP/
$       FUTIL           TP,CC,COPY/1F/,HOLD/TP/
$       FUTIL           TP,RS,COPY/1F/,HOLD/TP/
$       FUTIL           TP,IH,RREST/1F/,RWD/TP/
$       PRMFL           AA,W,L,LCOM.II/V3.0/MAINCSTR
$       PRMFL           AE,W,L,LCOM.II/V3.0/DCDRCSTR
$       PRMFL           AF,W,L,LCOM.II/V3.0/PRTSSORT
$       PRMFL           AG,W,L,LCOM.II/V3.0/PRTSCSTR
$       PRMFL           AH,W,L,LCOM.II/V3.0/MTRXSORT
$       PRMFL           AI,W,L,LCOM.II/V3.0/MTRXCSTR
$       PRMFL           AJ,W,L,LCOM.II/V3.0/GRPHCSTR
$       PRMFL           AK,W,L,LCOM.II/V3.0/DSPLCSTR
$       PRMFL           AL,W,L,LCOM.II/V3.0/MSNCSTR
$       PRMFL           SS,W,L,LCOM.II/V3.0/SEQSORT
$       PRMFL           SE,W,L,LCOM.II/V3.0/SEQCSTR
$       PRMFL           SP,W,L,LCOM.II/V3.0/SAMPPROB
$       PRMFL           CU,W,L,LCOM.II/V3.0/CHNG.UNC
$       PRMFL           CC,W,L,LCOM.II/V3.0/CHNG.CON
$       PRMFL           RS,W,L,LCOM.II/V3.0/RESTCSTR
$       PRMFL           IH,W,R,LCOM.II/V3.0/INPTHSTR
$       TAPE            TP,X1DD,,XXXXX,,SR.V3./5E
$       ENDJOB
-------------------------------------------------------------------------------
$       IDENT           WP1355,MSMET  LCOM INPUT MODULE - RUN 3
$       *               ****INPUT MODULE RUN OF PROVIDED SAMPLE PROBLEM****
$       USERID          LCOM.II$XXXXXX
$       PROGRAM         RLHS
$       PRMFL           H*,E,R,LCOM.II/V3.0/INPTHSTR
$       LIMITS          15,32K,,5K
$       FFILE           07,NOSLEW
$       PRMFL           07,R/W,S,LCOM.II/V3.0/INIT.SP
$       FFILE           09,NOSLEW
$       PRMFL           09,W,S,LCOM.II/V3.0/EXOG.60D
$       PRMFL           17,R,S,CACI/SIMERR
$       PRMFL           10,R,S,LCOM.II/V3.0/SAMPPROB
SPEC INFO=3 FORM=10 EXOG=9
$       ENDJOB
$       *               ****EXCHANGE & EXTRA CARD FOR ABOVE RUN TO
$       *                   REDIRECT ALL PRINT TO UNIT 15****
SPEC INFO=3 FORM=10 PRNT=15
$       PRMFL           15,W,L,LCOM.II/V3.0/PRNTFILE
```

Table A-1 cont.

```
$       IDENT           WP1355,MSMET  MAIN SIMRUN - RUN4U
$       *               ****MAIN SIMRUN (UNCON) USING RUN 3 DATA ****
$       USERID          LCOM.II$XXXXXX
$       LIMITS          ,,,15K
$       LOWLOAD
$       OPTION          FORTRAN,GO
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/MAINCSTR
$       EXECUTE
$       LIMITS          85,87K,-3K,15K
$       FFILE           04,NOSLEW
$       TAPE            04,X4DD,,XXXXX,,U.SIMOUT/RNG
$       FILE            08,X8R
$       FFILE           07,NOSLEW
$       PRMFL           07,R,L,LCOM.II/V3.0/INIT.SP
$       PRMFL           09,W,L,LCOM.II/V3.0/I.SIMOUT
$       PRMFL           10,R,L,LCOM.II/V3.0/EXOG.60D
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       DATA            11
$       SELECT          LCOM.II/V3.0/CHNG.UNC
$       DATA            05
  SPEC  CHNG=11  DATA=09  EXOG=10
$       ENDJOB
-------------------------------------------------------------------------------
$       *               **EXCHANGE CARDS TO MAKE ABOVE RUN CONSTRAINED**
$       SELECT          LCOM.II/V3.0/CHNG.CON
$       TAPE            04,X4DD,,XXXXX,,C.SIMOUT/RNG
$       *               **EXCHANGE CARDS TO TAKE MEMORY DUMPS**
$       TAPE            08,X8D,,XXXXX,,LCOMDUMP/RNG
  SPEC  CHNG=11  DATA=09  DUMP=08  EXOG=10
-------------------------------------------------------------------------------
$       IDENT           XXXXXX,MSMET - MAIN SIMRUN RESTART - RUN 4R
                        ******ALL JCL IS IDENTICAL TO RUN 4 JCL (WITH THE
                        MEMORY DUMP EXCHANGE CARDS) EXCEPT FOR:
                        (1)  SUBSTITUTE
$       SELECT          LCOM.II/V3.0/RESTCSTR
                        FOR
$       SELECT          LCOM.II/V3.0/MAINCSTR
                        (2)  SUBSTITUTE SPEC CARD
SPEC  REST=8  CHEK=5
                        (3)  ADD CHANGE CARDS (SEE WRITE-UP FOR FORMAT)
                                RESTO1
RUN
RECRD       7             5.0                 8
PSROUT                    27.0
 G6,G2,G4,G5,29,39,32 *
PSROUT                    49.0
 1,13,27,40,48,58,67 *
PSROUT                    59.0
 ALL *
STOP                      60.0
                        AFTER
$       SELECT          LCOM.II/V3.0/CHNG.UNC
```

Table A-1 cont.

```
$       IDENT           WP1355,MSMET            RUN 5
$       *               ****DECODER RUN USING RUN 4 DATA ****
$       USERID          LCOM.II$XXXXXX
$       LOWLOAD
$       OPTION          FORTRAN,NOMAP
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/DCDRCSTR
$       EXECUTE         DUMP
$       LIMITS          15,20K,,10K
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       DATA            05
SPEC GRPD=9 PRTS=10 MTRX=13 DPLY=12
SEQ=8 RFS=11 DBUG=0 *
$       FFILE           12,NOSLEW
$       PRMFL           12,W,S,LCOM.II/V3.0/DSPL.OUT
$       TAPE            01,X2DD,,XXXXX,,U.SIMOUT
$       FFILE           09,NOSLEW
$       PRMFL           09,W,S,LCOM.II/V3.0/GRPH.OUT
$       FFILE           10,NOSLEW
$       PRMFL           10,W,S,LCOM.II/V3.0/PRTSDICT
$       FFILE           14,NOSLEW
$       TAPE            14,X3D,,XXXXX,,PRTS.BCD/RING
$       PRMFL           13,W,S,LCOM.II/V3.0/MTRXDICT
$       FFILE           13,NOSLEW
$       FFILE           15,NOSLEW
$       TAPE            15,X4D,,XXXXX,,MTRX.BCD/RING
$       FFILE           11,NOSLEW
$       TAPE            11,X11DD,,XXXXX,,RFS.DATA/RNG
$       FFILE           08,NOSLEW
$       TAPE            08,X8DD,,XXXXX,,SEQ.DATA/RNG
$       ENDJOB
-------------------------------------------------------------------------------------------
$       IDENT           WP1355,MSMET            RUN 6
$       *               ****PARTS POST PROCESSOR USING RUN 5 DATA ****
$       USERID          LCOM.II$XXXXXX
$       LIMITS          15
$       LOWLOAD
$       SELECT          LCOM.II/V.3.0/PRTSSORT
$       EXECUTE
$       LIMITS          15,16K,,1000
$       TAPE            SA,X4D,,XXXXX,,PRTS.BCD
$       TAPE            SA,X5C,,XXXXX,,PRTS.OUT/RNG
$       FILE            S1,A1,50R
$       FILE            S2,A2,50R
$       FILE            S3,A3,50R
$       LOWLOAD
$       OPTION          FORTRAN,NOMAP
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/PRTSCSTR
$       EXECUTE
$       LIMITS          5,14K,,2K
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       DATA            05
 SPEC   DAYS=60
$       PRMFL           01,R,S,LCOM.II/V3.0/PRTSDICT
$       TAPE            02,X5DD,,XXXXX,,PRTS.OUT
$       ENDJOB
```

Table A-1 cont.

```
$       IDENT           WP1355,MSMET                RUN 8
$       *               **MATRIX POST PROCESSOR USING RUN 5 DATA **
$       USERID          LCOM.II$XXXXXX
$       LIMITS          50,,,10K
$       *               * MATRIX SORT *
$       SELECT          LCOM.II/V3.0/MTRXSORT
$       EXECUTE
$       LIMITS          15,30K
$       TAPE            SA,X9DD,,XXXXX,,MTRX.BCD
$       TAPE            SZ,A5S,,XXXXX,,MTRX.OUT/RNG
$       FILE            S1,A1,100R
$       FILE            S2,A2,100R
$       FILE            S3,A3,100R
$       *               * MATRIX PROGRAM *
$       LOWLOAD
$       OPTION          FORTRAN,NOMAP
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/MTRXCSTR
$       EXECUTE
$       LIMITS          30,30K,,10K
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       PRMFL           01,R,S,LCOM.II/V3.0/MTRXDICT
$       TAPE            02,A5DD
$       DATA            05
SPEC DICT=1 IN=2 NUM=9 STRT=10 STOP=60
NBLK=2 BLK1=5 BLK2=2 *
CREWCH1253000816
CREWCH2253000816
OMPERS1253000816
OMPERS2253000816
FLTENG1253000816
FLTENG2253000816
HYDTEC1253000816
HYDTEC2253000816
HYDSPL1253000816
HYDSPL2253000816
COMTEC1253000816
COMTEC2253000816
COMSPL1253000816
COMSPL2253000816
MUNSPL1253051321
MUNSPL2253051422
CAMTEC1253051422
CAMTEC2253051422
$       ENDJOB
```

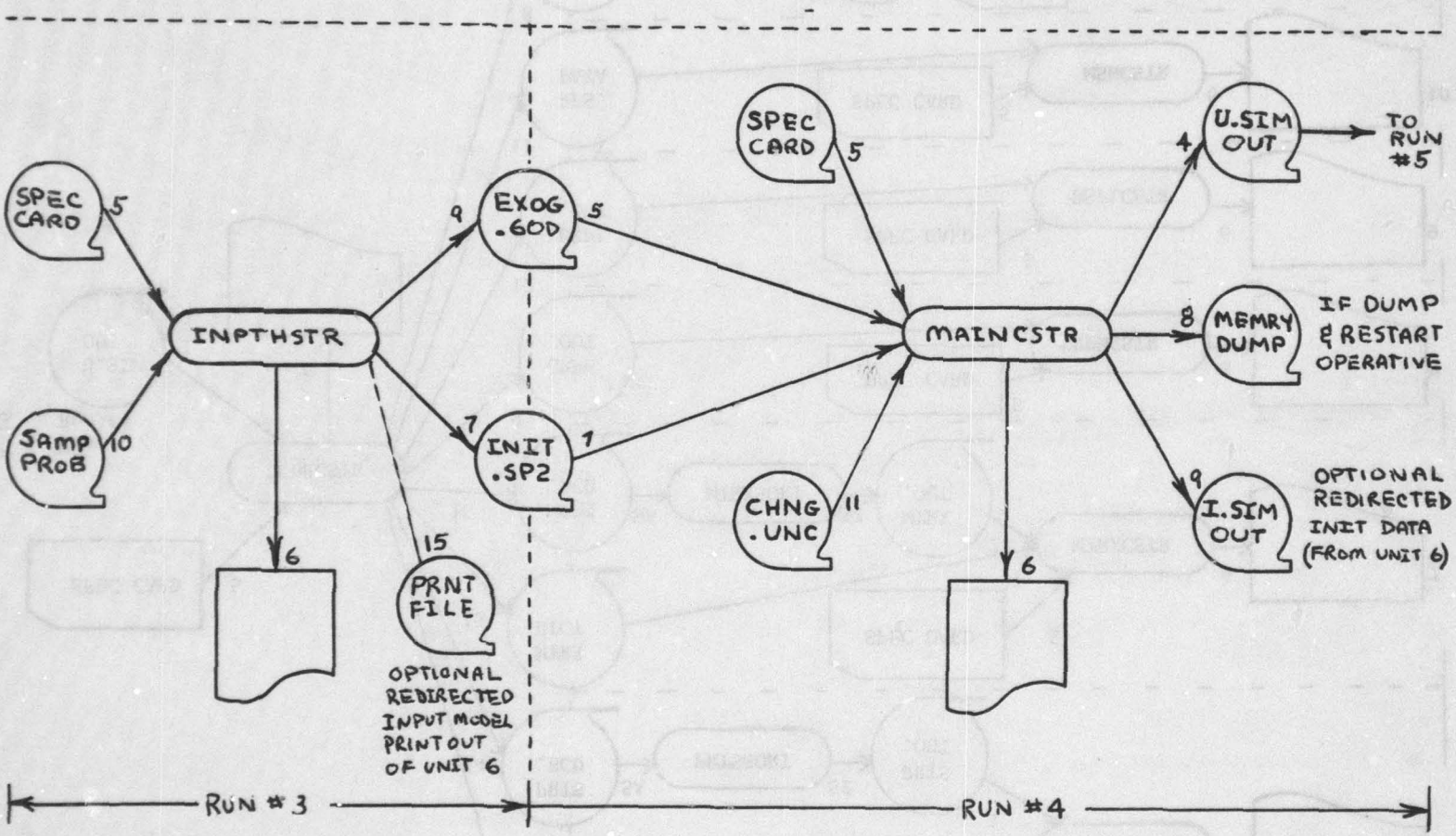
Table A-1 cont.

```
$       IDENT           WP1355,MSMET                RUN 7
$       *               ****GRAPH POST PROCESSOR USING RUN 5 DATA ****
$       USERID          LCOM.II$XXXXXX
$       LOWLOAD
$       OPTION          FORTRAN,NOMAP
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/GRPHCSTR
$       EXECUTE
$       LIMITS          15,15K,-3K,5K
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       DATA            05
  SPEC DAYS=10 STAT=6 STRT=1 STOP=60 DBUG=4
  3 6 24 34 41 53 *
$       PRMFL           01,R,S,LCOM.II/V3.0/GRPH.OUT
$       ENDJOB
-------------------------------------------------------------------------------
$       IDENT           WP1355,MSMET                RUN 9
$       *               ****DISPLAY POST PROCESSOR USING RUN 5 DATA ****
$       USERID          LCOM.II$XXXXXX
$       LIMITS          10,,,6K
$       LOWLOAD
$       OPTION          FORTRAN,NOMAP
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/DSPLCSTR
$       EXECUTE
$       LIMITS          15,12K,,5K
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       DATA            05
  SPEC DBUG=3
$       PRMFL           01,R,S,LCOM.II/V3.0/DSPL.OUT
$       ENDJOB
-------------------------------------------------------------------------------
$       IDENT           WP1355,MSMET                RUN 10
$       *               ****MISSION POST PROCESSOR USING RUN 5 DATA****
$       USERID          LCOM.II$XXXXXX
$       LOWLOAD
$       OPTION          FORTRAN,NOMAP
$       LIBRARY         SL
$       SELECT          LCOM.II/V3.0/MSNCSTR
$       EXECUTE
$       LIMITS          15,20K,,15K
$       PRMFL           SL,R,S,CACI/SIM2LIB
$       PRMFL           17,R,S,CACI/SIMERR
$       DATA            05
SPEC IN=9 STOP=60 LVL1=10 LVL2=3 NERR=50 *
$       TAPE            09,X9DD,,XXXXX,,RFS.DATA
$       ENDJOB
```

Table A-1 cont.

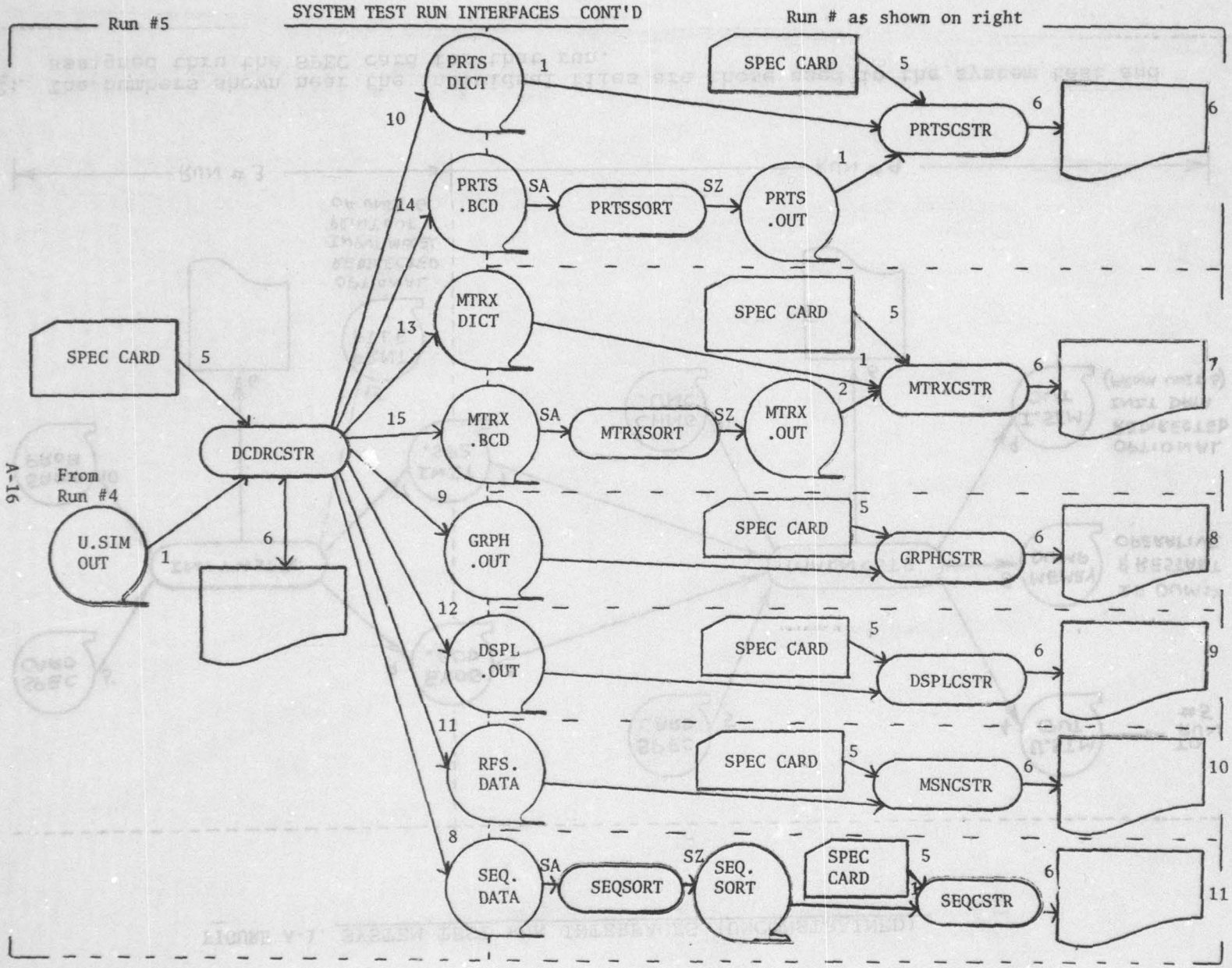
```
$$      IDENT       MSMET       RUN11
$       *           ****SUPPORT EQUIPMENT PP USING RUN 5 DATA****
$       USERID      LCOM.II$XXXXXX
$       SELECT      LCOM.II/V3.0/SEQSORT
$       EXECUTE
$       TAPE        SA,X1DD,,XXXX,,SEQ.DATA
$       TAPE        SZ,X2S,,XXXXX,,SEQ.OUT
$       FILE        S1,A1R,50R
$       FILE        S2,A2R,50R
$       FILE        S3,A3R,50R
$       LOWLOAD
$       OPTION      FORTRAN
$       LIBRARY     SL
$       SELECT      LCOM.II/V3.0/SEQCSTR
$       EXECUTE
$       LIMITS      5,14K
$       PRMFL       SL,R,S,CACI/SIM2LIB
$       PRMFL       17,R,S,CACI/SIMERR
$       DATA        05
SPEC IN=1 NUM=1
10 *
$       TAPE        01,X2DD
$       ENDJOB
```

FIGURE A-1. SYSTEM TEST RUN INTERFACES (UNCONSTRAINED)



NOTE: The numbers shown near the individual files are those used in the system test and assigned thru the SPEC card for that run.

SYSTEM TEST RUN INTERFACES CONT'D



```
0307T C1  10/10/79        UTILITY  REPORT  731111                PAGE       1

$       OUTIL   EOF/ALL
$       FUTIL   TP,AA,COPY/1F/,SKIP/1F/,HOLD/TP/
 COPIED             1 FILES,    3689 RECORDS IN LAST FILE

FILE CODE TP SKIPPED           1 FILES,    4191 RECORDS IN LAST FILE

$       FUTIL   TP,AB,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     548 RECORDS IN LAST FILE

$       FUTIL   TP,AP,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,       9 RECORDS IN LAST FILE

$       FUTIL   TP,AQ,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     175 RECORDS IN LAST FILE

$       FUTIL   TP,AM,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,      10 RECORDS IN LAST FILE

$       FUTIL   TP,AN,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     980 RECORDS IN LAST FILE

$       FUTIL   TP,AC,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     345 RECORDS IN LAST FILE

$       FUTIL   TP,AK,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     196 RECORDS IN LAST FILE

$       FUTIL   TP,AR,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     692 RECORDS IN LAST FILE

$       FUTIL   TP,SB,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,      10 RECORDS IN LAST FILE

$       FUTIL   TP,SB,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     225 RECORDS IN LAST FILE

$       FUTIL   TP,SR,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     491 RECORDS IN LAST FILE


$       FUTIL   TP,CU,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     103 RECORDS IN LAST FILE

$       FUTIL   TP,CG,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,     103 RECORDS IN LAST FILE

$       FUTIL   TP,RS,COPY/1F/,HOLD/TP/
 COPIED             1 FILES,      31 RECORDS IN LAST FILE

$       FUTIL   TP,IN,BREST/1F/,BWD/TP/
 BRESTD             1 FILE
```

FIGURE A-2. SYSTEMS IMPLEMENTATION UTILITY REPORT.

```
                                LCOMII STANDARD VERSION  HIS  RELEASE  3.5.1
SPEC GRPD=9 PRTS=10 MTRX=13 DPLY=12
SE@=8 RFS=11 DBUG=0 *
THE FOLLOWING POST PROCESSORS WERE REQUESTED USING THESE LOGICAL UNITS
     GRAPH POST PROCESSOR OUTPUT UNIT =  9
     DISPLAY POST PROCESSOR OUTPUT UNIT = 12
     RFS POST PROCESSOR OUTPUT UNIT = 11
     PARTS POST PROCESSOR DICTIONARY OUTPUT UNIT = 10
                          BCD DATA OUTPUT UNIT = 14
     MATRIX POST PROCESSOR DICTIONARY OUTPUT UNIT = 13
                           BCD DATA OUTPUT UNIT = 15
     SUPPORT EQUIPMENT POST PROCESSOR OUTPUT UNIT =  8
     THE 'POST' FILE OR INPUT UNIT =  1

 USE THE SEQUENCE NUMBER TO THE LEFT OF EACH DESIRED STATISTIC FOR PRINTING IN THE GRAPH POST PROCESSOR.

   1     1 NUMBER OF MISSIONS REQUESTED      2     2       NUMBER ACCOMPLISHED      3     3       PERCENT ACCOMPLISHED
   4     6 NUMBER OF SORTIES REQUESTED       5     7       NUMBER ACCOMPLISHED      6     8       PERCENT ACCOMPLISHED
   7    T1 NUMBER OF WEATHER CANCELS         8    T2 NUMBER OF WEATHER DELAYS      9    T3 NUMBER OF ALERT REPLENISHMENT
  10    T4 NUMBER OF ATTRITIONS             11    T5 NUMBER OF RAM REPAIRS        12    T6 NUMBER OF AIR ABORTS(TOTAL)
  13    A1 AVG. AC POST SORTIE TIME(HRS)    14    A2 NO. OF POST-SORTIES COMPLETED 15    13 NUMBER OF AIRCRAFT AUTH.(EOP)
  16    14 NUMBER OF AIRCRAFT-DAYS AVAIL    17    15       PCT SORTIES(INCL ALERT) 18    16       PCT UNSCHED MAINTENANCE
  19    17       PCT SCHED MAINTENANCE      20    18       PCT NORS                21    19       PCT MISSION WAIT STATUS
  22    20       PCT SERVICE + WAITING      23    21       PCT OPERATIONALLY READY 24    22 AVG. AC POST SORTIE TIME(HRS)
  25    23 AVG. NO. OF SORTIES/ A/C /DAY    26    24 FLYING HOURS                  27    77 NUMBER OF FCF TASKS FLOWN
  28    T8 AVG. AC PRESORTIE TIME(HRS)      29    27 MANHOURS AVAILABLE (100)      30    28 PERCENT  UTILIZATION
  31    29 MANHOURS USED (100)              32    30 PCT UNSCHED MAINT. OF STAT 29 33    31 PCT SCHED  MAINT. OF STAT 29
  34    P1 PCT PRIME          OF STAT 29    35    P2 PCT SUBSTITUTE     OF STAT 29 36    33 NUMBER OF MEN DEMANDED
  37    P3 NBR OF MEN DEMANDED POST SCAN    38    34 % AVAIL BY OH. BAL. OF RES    39    35 % AVAIL BY GEN SUBS OF RES
  40    36 % AVAIL BY EXPEDITE PROC.        41    37 % AVAIL BY PREEMPTION PROC.   42    38 % DEMANDS NOT AVAIL FOR RES
  43    39 OVERTIME MANHOURS USED (100)     44    40 SIMULATED MH PER FLYING HOUR  45    44 NO. OF REPARABLE GENERATIONS
  46    45       PCT BASE REPAIR            47    46       PCT DEPOT REPAIR        48    47 AVERAGE BASE REPAIR CYCLE
  49    48       PCT ACTIVE REPAIR          50    49       PCT WHITE SPACE         51    50 NO. OF ITEMS IN REPAIR (EOP)
  52    51 NO. OF ITEMS BACKLOGGED (EOP)    53    54 TOT DOLLAR INVEST.(1000)(EOP) 54    55 FILL RATE PERCENT
  55    56 NUMBER OF BACKORDER-DAYS         56    57 NUMBER OF UNITS DEMANDED      57    58       PCT OFF-THE-SHELF
  58    59       PCT EXPEDITED REPAIR       59    60       PCT PREEMPTION          60    61       PCT DEMANDS NOT SATIS.
  61    62 NUMBER OF CANNIBALIZATIONS       62    63 NO. ITEMS ON BACKORDER (EOP)  63    68 TOT DOLLAR INVEST.(1000)(EOP)
  64    69 EQUIPMENT HOURS AUTH. (100)      65    70 EQUIPMENT HOURS AVAIL. (100)  66    71       PCT USED-UNSCHED MAINT
  67    72       PCT USED-SCHED MAINT       68    73       PCT UNUSED              69    74 NUMBER OF BACKORDER-DAYS
  70    75 NUMBER OF UNITS DEMANDED         71    76       PCT AVAILABLE           72    77       PCT PROV. BY EXPEDITE
  73    78       PCT PROV. BY PREEMPTION    74    79       PCT DEMANDS NOT SATIS.  75    80 EQUIP HOURS BACKLOG(100)(EOP)

 PUT THESE VALUES ON THE GRAPH 'SPEC' CARD     DAYS=  10 FDAY=   0, IF NON-ZERO.

  1621 RECORDS WERE WRITTEN TO THE GRAPH FILE.
   292 RECORDS WERE WRITTEN TO THE DISPLAY FILE.
    10 RECORDS WERE WRITTEN TO THE PARTS  BINARY FILE.
 11773 RECORDS WERE WRITTEN TO THE PARTS  BCD FILE.
     1 RECORDS WERE WRITTEN TO THE MATRIX BINARY FILE.
 93070 RECORDS WERE WRITTEN TO THE MATRIX BCD FILE.
  5726 RECORDS WERE WRITTEN TO THE RFS FILE.
  1275 RECORDS WERE WRITTEN TO THE SUPPORT EQUIPMENT FILE.
     0 RECORDS WERE WRITTEN TO THE TASK POST PROCESSOR FILE.
DECODER PROGRAM COMPLETED. PLEASE ANALIZE AND CORRECT ERRORS BEFORE RUNNING ANY POST PROCESSOR.
```

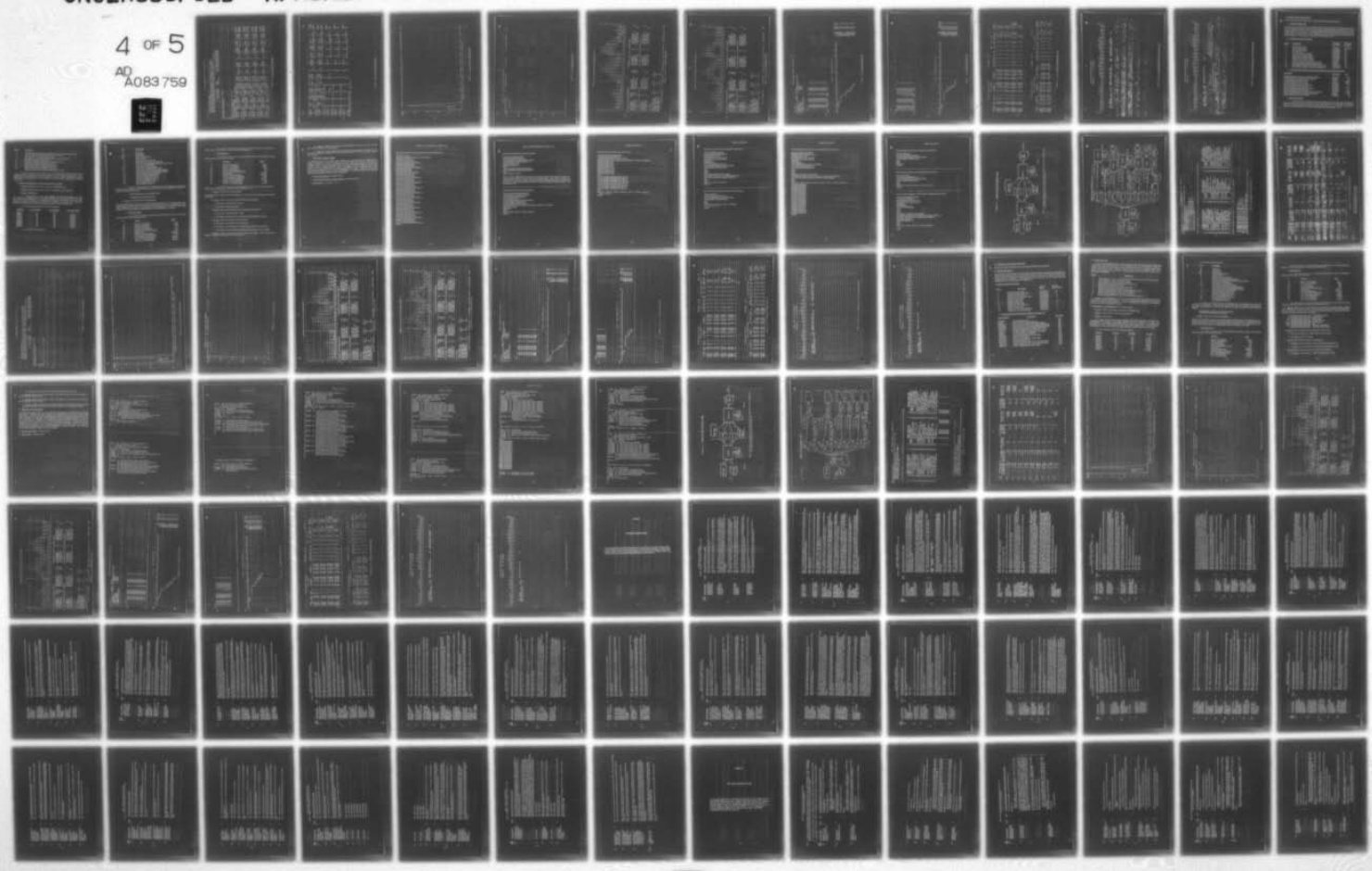
FIGURE A-3. SAMPLE PROBLEM 3.5's DECODER OUTPUT (HIS).

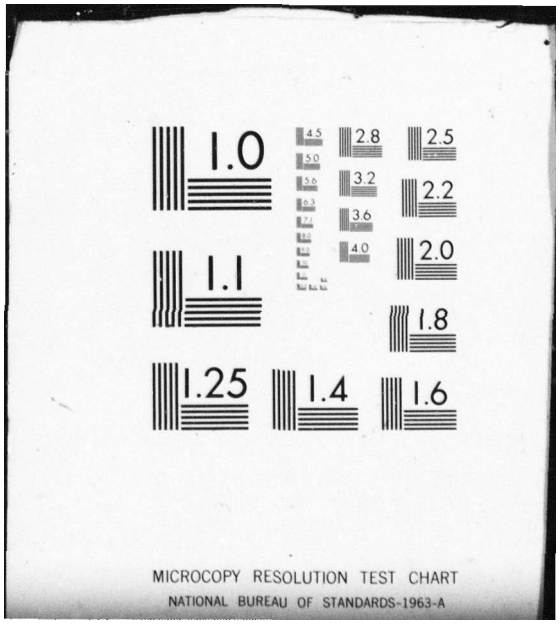
PART WUC	STANDARD STATISTICS			BASE STATISTICS			DEPOT STATISTICS		
	UNIT COST	NO. DEMANDS	# DAYS STOCK OUT	NO. REPAIRED	MAX CYCLE TIME		NO. REPAIRED	MAX CYCLE TIME	
	AUTHORIZED LEVEL	AVG DAILY DEMAND	# DAYS BACKORDER	NO. CONDEMNED	AVG CYCLE TIME		NO. CONDEMNED	AVG CYCLE TIME	
	AVG QUAN ON HAND	DEMDS NOT SATIS.	BACKORDER RATE	CONDEMNED RATE	STD DEV C-TIME		CONDEMNED RATE	STD DEV C-TIME	
	MIN QUAN ON HAND	TIME BETWN DEMDS		AV DECISION TIME			BASE NRTS RATE		
PUMPH1	$ 100.00	19	0.	10	1.588918		9	27.250258	
	99	.3167	0.	0	1.033208		0	16.764144	
	96.3154	0	0. %	0. %	.327342		0. %	5.011970	
	95	3.125967		.009051			47.368 %		
PUMPH2	$ 100.00	71	0.	65	3.062317		6	22.972192	
	99	1.1833	0.	0	2.004377		0	18.329508	
	95.0845	0	0. %	0. %	.506021		0. %	6.692789	
	92	.849778		.010395			8.451 %		
RDASSY	$ 1000.00	1158	0.	1158	.102192		0	0.	
	99	19.3000	0.	0	.080839		0	0.	
	97.5747	0	0. %	0. %	.006799		0. %	0.	
	91	.051734		.010397			0. %		
RADC11	$ 500.00	737	0.	536	.109699		201	42.498483	
	299	12.2833	0.	0	.072978		0	19.474180	
	233.1941	0	0. %	0. %	.010867		0. %	5.784214	
	220	.080875		.010384			27.273 %		
RADC12	$ 500.00	774	0.	642	.089406		132	34.862710	
	299	12.9000	0.	0	.072891		0	20.717972	
	252.7268	0	0. %	0. %	.004531		0. %	5.671633	
	244	.077423		.010417			17.054 %		
BMS500	$ 1000.00	3464	0.	156	0.		3302	.000002	
	9999	57.7333	0.	0	0.		0	.000000	
	9315.6487	0	0. %	0. %	0.		0. %	.000001	
	9249	.017093		.000000			95.489 %		
SMTBMS	$ 18000.00	1200	0.	0	0.		1200	.000002	
	9999	20.0000	0.	0	0.		0	.000000	
	9756.7664	0	0. %	0. %	0.		0. %	.000000	
	9727	.049222		.000000			100.000 %		
MISSLS	$ 14000.00	524	0.	38	0.		471	.000002	
	999	8.7333	0.	0	0.		0	.000000	
	891.6972	0	0. %	0. %	0.		0. %	.000000	
	876	.112844		.000000			92.534 %		
CAMERA	$ 2600.00	110	0.	114	.076529		0	0.	
	99	1.8333	0.	0	.061097		0	0.	
	101.2316	0	0. %	0. %	.005922		0. %	0.	
	99	.543960		0.			0. %		

FIGURE A-4. S.P. 3.5's PART POST PROCESSOR OUTPUT (HIS)

AD-A083 759 AIR FORCE MAINTENANCE AND SUPPLY MANAGEMENT ENGINEERI--ETC F/G 9/2
LCOM II SIMULATION SOFTWARE USERS REFERENCE GUIDE,(U)
OCT 79 W F DRAKE, R C REISS
UNCLASSIFIED AFMSMET-78-5.1 NL

4 OF 5
AD A083759




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
7.1
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

```
        GRAPHING SPECIFICATIONS
        THE VALUE OF EACH X-COORDINATE ON THE GRAPHS IS PRINTED SUCH THAT THE RIGHT
        MOST DIGIT IS PRINTED UNDER THE CORRESPONDING X-COORDINATE (* OR PSR POINT).
        WHEN THE STATISTICS ARE GRAPHED THE NUMBER OF PAGES NEEDED TO GRAPH EACH
        STATISTIC WILL DEPEND ON THE NUMBER OF PSR'S THAT ARE WITHIN THE STRT - STOP INTERVAL.

                          1 - 30 PSR POINTS     1 PAGE          3 X-AXIS SPACES BETWEEN PSR POINTS
                         31 - 60 PSR POINTS     1 PAGE          1 X-AXIS SPACE BETWEEN PSR POINTS
                         61 - MAX PSR POINTS    MAX/60 PAGES    1 X-AXIS SPACE BETWEEN PSR POINTS

 SPEC DAYS=10 STAT=6 STRT=1 STOP=60 DBUG=4
THE STATISTICS TO BE GRAPHED
 3
 6
24
34
41
53
FORECAST STATISTICS WILL NOT BE GRAPHED.
GRAPH TITLES HAVE BEEN READ.
 IN MAIN.CARD.READ RELEASED.
STATISTICS RECORD    1 READ. TIME =  20.000000
  130.0000  150.0000  100.0000  270.0000  269.0000   99.6296      0.         0.         0.         2.0000     2.0000     0.         3.1010
  267.0000   20.0000  207.8336    6.3821   15.1715    9.6822      0.         9.5460     0.        59.2183     3.1010     1.2943   318.3401
       0.     1.3422 2138.4004    1.7694   37.8371   74.1519     25.8481   100.0000     0.      6471.0000  6471.0000   100.0000     0.
       0.        0.       0.       0.     11.8857 1173.0000     37.7664    62.2336     .1464   100.0000     0.         4.0000   102.0000
2.0464E 05  100.0000     0.     1333.0000  100.0000     0.         0.         0.         0.         0.       594.0000   237.6000   237.6000
     .1479     0.      99.8521     0.      216.0000  100.0000     0.         0.         0.         0.
STATISTICS RECORD    2 READ. TIME =  30.000000
  149.0000  149.0000  100.0000  268.0000  266.0000   99.2537      0.         0.         0.         0.         0.         0.         3.0552
  269.0000   20.0000  200.0000    6.3499   15.7964    9.9388      0.         9.7484     0.        58.1747     3.0552     1.3308   304.7943
       0.     1.3748 2138.4006    1.7228   36.8409   73.8554     26.1446   100.0000     0.      6338.0000  6338.0000   100.0000     0.
       0.        0.       0.       0.     12.0871 1299.0000     34.0262    65.9738     .1152   100.0000     0.         5.0000   113.0000
2.0464E 05  100.0000     0.     1315.0000  100.0000     0.         0.         0.         0.         0.       594.0000   237.6000   237.6000
     .1557     0.      99.8443     0.      212.0000  100.0000     0.         0.         0.         0.
STATISTICS RECORD    3 READ. TIME =  40.000000
  151.0000  151.0000  100.0000  272.0000  270.0000   99.2647      0.         0.         0.         0.         0.         0.         3.0067
  267.0000   20.0000  200.0000    6.6997   15.6617   10.0045      0.         9.5691     0.        58.1260     3.0067     1.3500   321.5859
       0.     1.3844 2138.4009    1.7312   37.8261   73.7474     26.2526   100.0000     0.      6303.0000  6303.0000   100.0000     0.
       0.        0.       0.       0.     11.5117 1373.0000     32.4836    67.5164     .1076   100.0000     0.         4.0000   113.0000
2.0464E 05  100.0000     0.     1335.0000  100.0000     0.         0.         0.         0.         0.       594.0000   237.6000   237.6000
     .1561     0.      99.8439     0.      201.0000  100.0000     0.         0.         0.         0.
STATISTICS RECORD    4 READ. TIME =  50.000000
  149.0000  149.0000  100.0000  268.0000  266.0000   99.2537      0.         0.         0.         0.         0.         0.         3.0338
  269.0000   20.0000  200.0000    6.7502   16.0284    9.9564      0.         9.3442     0.        57.9215     3.0338     1.3300   324.0082
       0.     1.4010 2138.4015    1.7684   37.8156   74.3424     25.6576   100.0000     0.      6433.0000  6433.0000   100.0000     0.
       0.        0.       0.       0.     11.6712 1310.0000     35.4962    64.5038     .1128   100.0000     0.         4.0000   116.0000
2.0464E 05  100.0000     0.     1343.0000  100.0000     0.         0.         0.         0.         0.       594.0000   237.6000   237.6000
     .1637     0.      99.8363     0.      210.0000  100.0000     0.         0.         0.         0.
STATISTICS RECORD    5 READ. TIME =  60.000000
```

FIGURE A-5. S.P. 3.5's GRAPH STAT VALUE PRINTOUT.

```
 150.8080  150.0000  100.0000  270.0000  270.0000  100.0000   0.        0.        0.        0.        0.        0.       20.0000
 200.8000    6.9770   16.6085   10.0614    0.        9.3454    0.       57.0422    3.1400    1.3580  334.8970    0.        1.3984
2138.4017    1.8237   38.9986   74.8849   25.1151  100.0000   0.     6698.0000 6698.0000  100.0000    0.        0.        0.
   0.        0.       11.6450 1389.0000   35.4932   64.5068    .1211  100.0000    0.        5.0000  116.0000 2.0464E 05  100.0000
   0.     1389.0000  100.0000    0.        0.        0.        0.        0.      594.0000  237.6000  237.6000    .1728    0.
  99.8272    0.       230.0000  100.0000    0.        0.        0.        0.
STATISTICS RECORD     6 READ. TIME =   70.000000
   1.8000    1.0000  100.0000    2.0000    2.0000  100.0000   0.        0.        0.        0.        0.        0.       20.0000
 200.8000     .2939     .1208     .0518    0.         .0000    0.       99.6804    3.2618     .0180   14.1091    0.        0.
2138.4021     .0158     .3381   78.9213   21.0787  100.0000   0.       62.0000   62.0000  100.0000    0.        0.        0.
   0.        0.        2.3961  819.0000     .6105   99.3895   1.0683  100.0000    0.        0.       69.0000 2.0464E 05  100.0000
   0.        7.0000  100.0000    0.        0.        0.        0.        0.      594.0000  237.6000  237.6000    .0016    0.
  99.9984    0.        3.0000  100.0000    0.        0.        0.        0.
STATISTICS RECORD     7 READ. TIME =   80.000000
   0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.       20.0000
 200.8000    0.        0.        0.        0.        0.        0.      100.0000    0.        0.        0.        0.        0.
2138.4023    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   0.        0.        0.      196.0000    0.      100.0000    0.        0.        0.        0.       14.0000 2.0464E 05    0.
   0.        0.        0.        0.        0.        0.        0.        0.      594.0000  237.6000  237.6000    0.        0.
 100.8000    0.        0.        0.        0.        0.        0.        0.
STATISTICS RECORD     8 READ. TIME =   90.000000
   0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.       20.0000
 200.8000    0.        0.        0.        0.        0.        0.      100.0000    0.        0.        0.        0.        0.
2138.4029    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.     2.0464E 05    0.
   0.        0.        0.        0.        0.        0.        0.        0.      594.0000  237.6000  237.6000    0.        0.
 100.8000    0.        0.        0.        0.        0.        0.        0.
STATISTICS RECORD     9 READ. TIME =  100.000000
   0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.       20.0000
 200.8000    0.        0.        0.        0.        0.        0.      100.0000    0.        0.        0.        0.        0.
2138.4037    0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   0.        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.     2.0464E 05    0.
   0.        0.        0.        0.        0.        0.        0.        0.      594.0000  237.6000  237.6000    0.        0.
 100.8000    0.        0.        0.        0.        0.        0.        0.
MAIN MODEL RUN ENDED AT 100.009999
AVE = 3.069 VAR = 1.107 MAX =   474.0 INTERVAL =10.0
```


FIGURE A-5. S.P. 3.5's GRAPH STAT VALUE PRINTOUT.

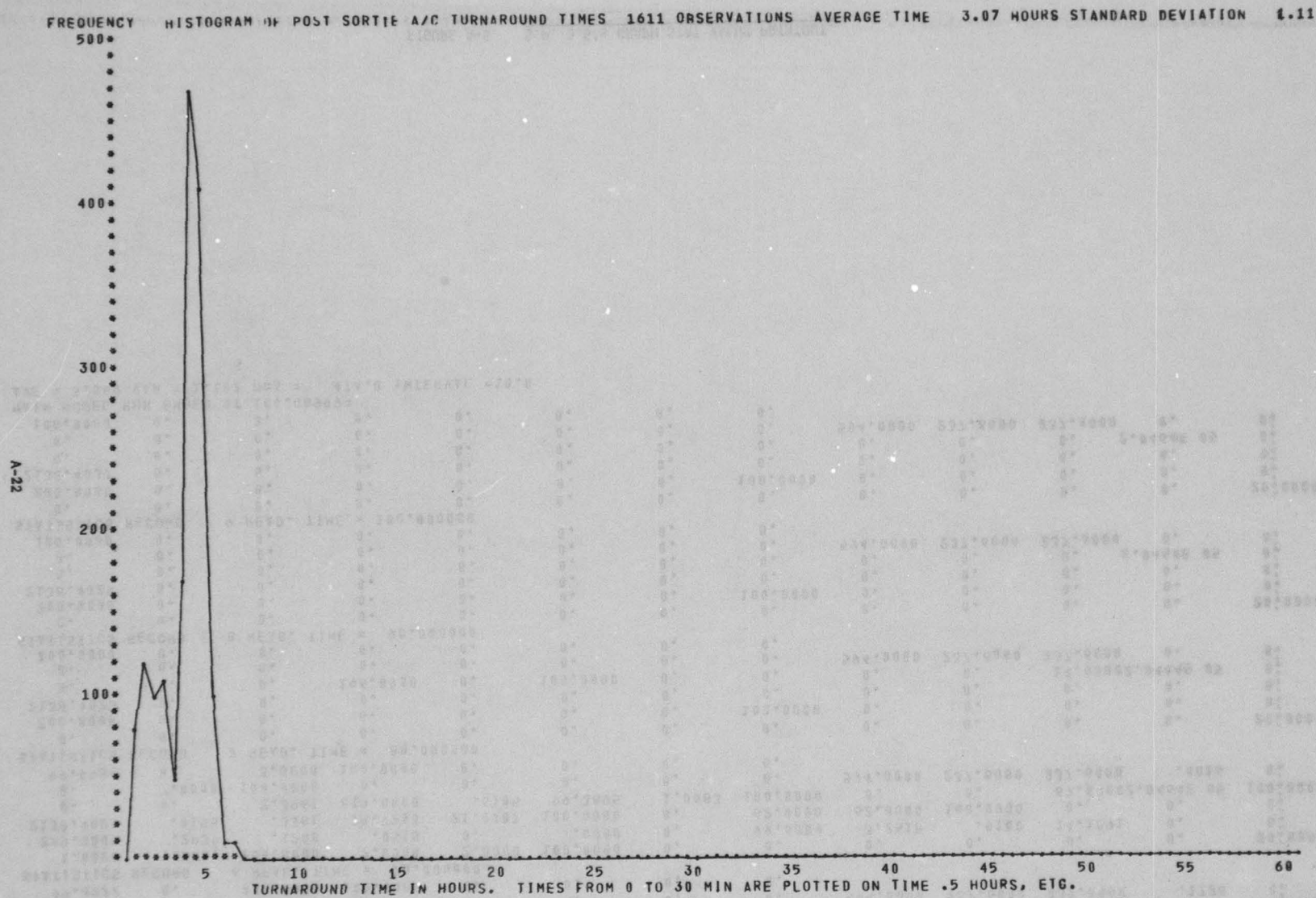


FIGURE A-6. S.P. 3.5's POST SORTIE TURNAROUND HISTOGRAM

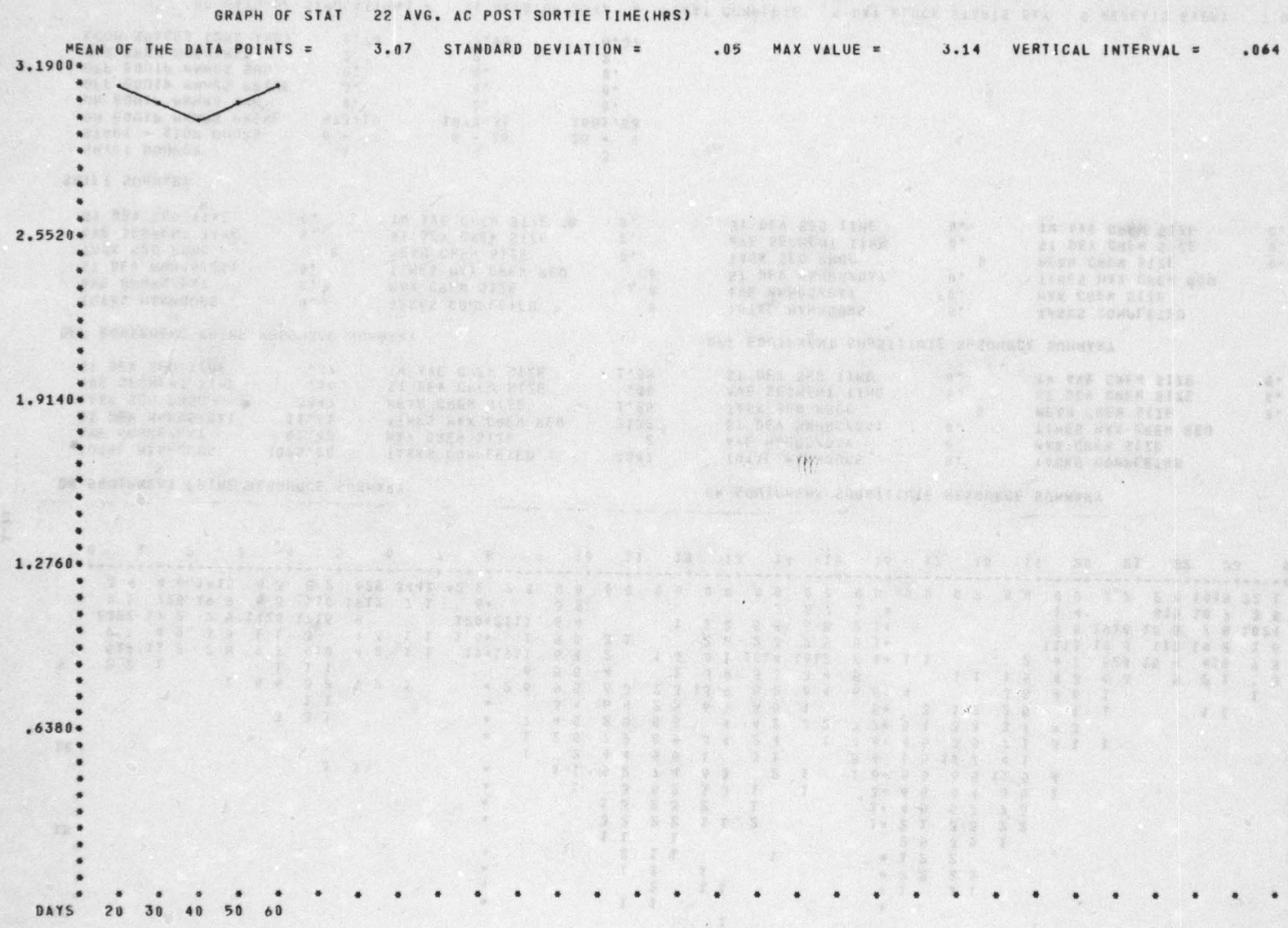
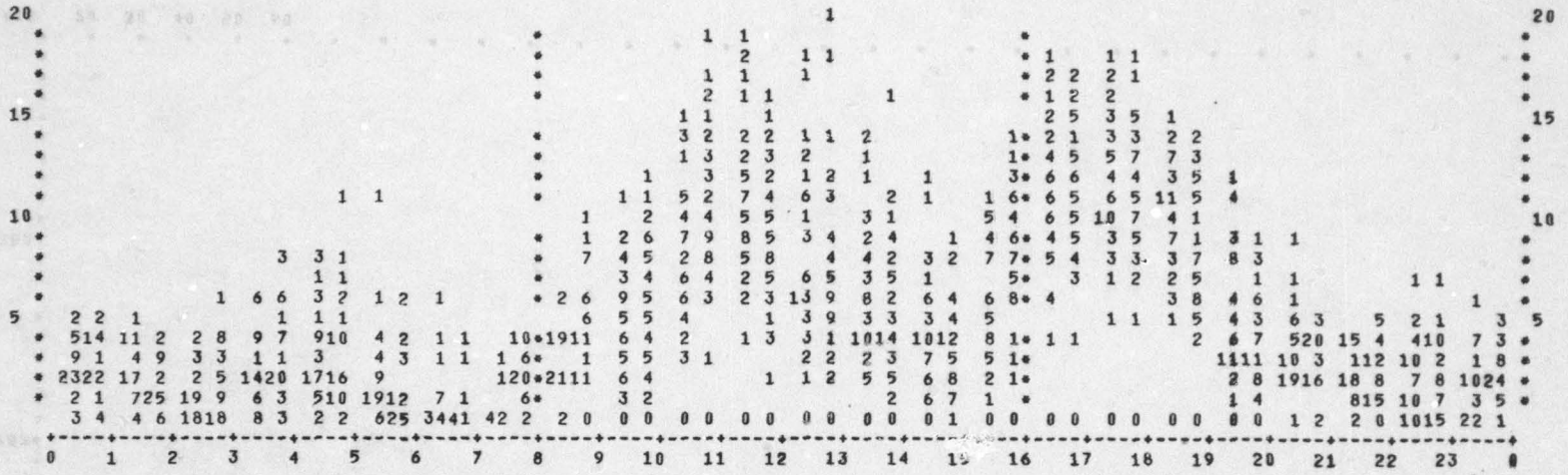


FIGURE A-7. S.P. 3.5's GRAPH OF STAT 22 (HIS).

PRODUCTIVE UTILIZATION MATRIX FOR RESOURCE COMTEC (7)



ON EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	4025.28	TASKS COMPLETED	3847
AVE MNHRS/DAY	91.48	MAX CREW SIZE	2
ST DEV MNHRS/DAY	11.61	TIMES MAX CREW REQ	2132
TASK SEG PROC	3847	MEAN CREW SIZE	1.55
AVE SEGMENT TIME	.66	ST DEV CREW SIZE	.50
ST DEV SEG TIME	.37	TW AVE CREW SIZE	1.58

ON EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

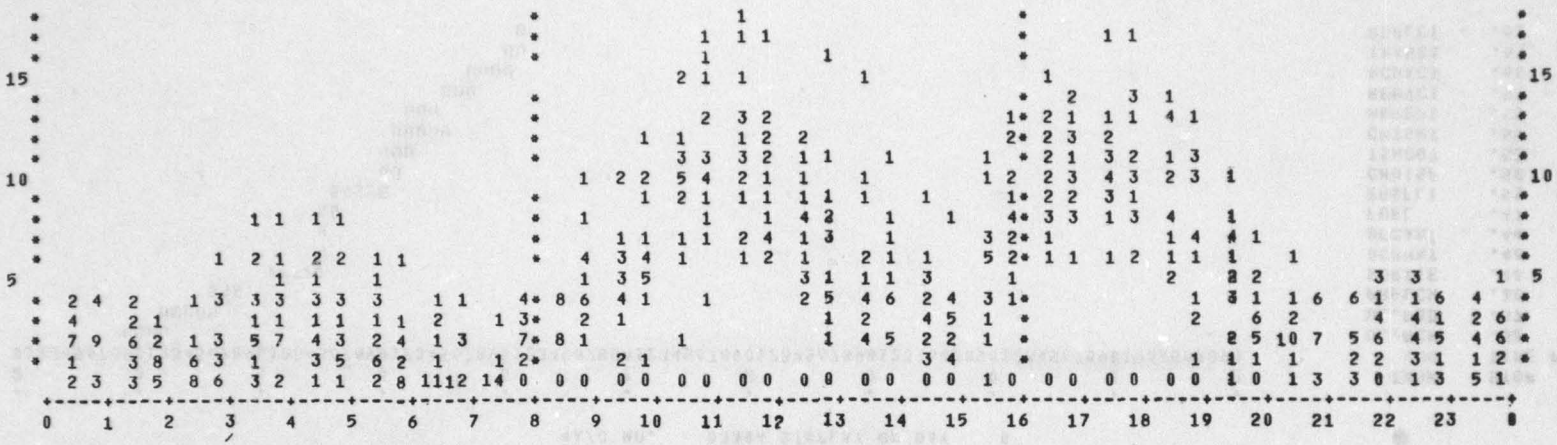
SHIFT SUMMARY

SHIFT NUMBER	1	2	3
START - STOP HOURS	0 - 8	8 - 16	16 - 0
ON EQUIP MNHRS PRIME	473.15	1870.31	1681.83
ON EQUIP MNHRS SUB	0.	0.	0.
OFF EQUIP MNHRS PRIME	0.	0.	0.
OFF EQUIP MNHRS SUB	0.	0.	0.
MAX CREW REQUIRED	2	2	2
LCOM SPACES (25% IND)	1.79	7.08	6.37

60 DAYS OF SIMULATION * 44 DAYS OF DATA * FIRST COMPLETE 5 DAY BLOCK STARTS DAY 0 REPEATS EVERY 7 DAYS

FIGURE A-8. PART 1. S.P. 3.5's MANPOWER MATRIX (HIS).

PRODUCTIVE UTILIZATION MATRIX FOR RESOURCE COMTEC (7)



ON EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	1417.41	TASKS COMPLETED	1356
AVE MNHRS/DAY	88.59	MAX CREW SIZE	2
ST DEV MNHRS/DAY	10.83	TIMES MAX CREW REQ	750
TASK SEG PROC	1356	MEAN CREW SIZE	1.55
AVE SEGMENT TIME	.66	ST DEV CREW SIZE	.50
ST DEV SEG TIME	.37	TW AVE CREW SIZE	1.58

ON EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

SHIFT SUMMARY

SHIFT NUMBER	1	2	3
START - STOP HOURS	0 - 8	8 - 16	16 - 0
ON EQUIP MNHRS PRIME	176.10	685.01	556.30
ON EQUIP MNHRS SUB	0.	0.	0.
OFF EQUIP MNHRS PRIME	0.	0.	0.
OFF EQUIP MNHRS SUB	0.	0.	0.
MAX CREW REQUIRED	2	2	2
LCOM SPACES (25% IND)	1.83	7.14	5.79

60 DAYS OF SIMULATION * 16 DAYS OF DATA * FIRST COMPLETE 2 DAY BLOCK STARTS DAY 5 REPEATS EVERY 7 DAYS

FIGURE A-8. PART 2. S.P. 3.5's MANPOWER MATRIX (HIS).

```
                                LCOMII STANDARD VERSION  HIS  RELEASE  3.5
 SPEC  DBUG=3
                      SYMBOL  MEANINGS
 B  OFF-EQUIPMENT ACTIVITIES    U  UNSCHEDULED MAINTENANCE
 C  CONDEMNED                   V  SERVICE TASK
 D  DEPOT ACTIONS               *  ILLEGAL
 F  ACTUAL FLIGHT               +  ILLEGAL
 L  IMPOSED DELAYS              -  ILLEGAL
 S  SCHEDULED MAINTENANCE

    83304
          .3000     82692      81    .3229        2
          .3229     82512      85    .3690        2
          .3690     82776       2    .3811        3
          .4167     82266       3    .4583        1
          .4583     82128       5    .4583        5
          .4583     82484      94    .4583        5
          .4583     82680       4    .4654        3
          .4654     82716       6    .5069        3
          .5069     82094      47    .5151        2
          .5069     82082      25    .5252        2
          .5252     82484      26    .5460        2
          .5151     82668      48    .5517        2
          .5517     82082      50    .5714        2
          .5714     82152      51    .6045        2
          .6045     82668      52    .6109        2
          .6109     81892      53    .6109        2
 TENTH=  2 HUNDREDTH=    9 BASE=      20
```

A-26

```
                                *A/C NO.    83304 DISPLAY ON DAY    0

.         .         .         .         .         .         .         .         .         .         .         .
2         3         4         5         6         7         8         9         0         1         2
01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
        UUUU
          UUUUU
             SSS
                FFFFF
                   V
                   V
                   SS
                    SSSSS
                        UU
                        UUU
                         UUUUU
                          UUU
                             UUU
                               UUUU
                                  UU
                                   U
```

TASK WUC	STOP TIME	NO. PREM
UL.RCK	.32	0
UL.POD	.37	0
PRELCH	.38	0
SORTIE	.46	0
DCRMNT	.46	0
DFCAM	.46	0
FUEL	.47	0
POSFLT	.51	0
CMDISP	.52	0
TSHOOT	.53	0
CMTSHT	.55	0
MNREP1	.55	0
REMVC1	.57	0
BCHKC1	.60	0
TRANC1	.61	0
REPLC1	.61	0

FIGURE A-9. S.P. 3.5's SAMPLE A/C DISPLAY (HIS).

```
83128
   16.8958    81754      1 16.9375      3
   16.9375    81690      2 16.9500      3
   17.0000    79480      3 17.1138      1
   17.1138    81690      5 17.1138      5
   17.1138    81412      4 17.1209      3
   17.1209    79480      6 17.1635      3
   17.1635    81754     47 17.1741      2
   17.1635    81412     25 17.1837      2
   17.1741    80116     48 17.1962      2
   17.1837    73488     26 17.1969      2
   17.1962    79480     50 17.2161      2
   17.2161    80802     51 17.2650      2
   17.2650    73488     52 17.2729      2
   17.2729    80506     53 17.2729      2
TENTH=168 HUNDREDTH=   9 BASE=    1680
```



```
                                    *A/C NO.    83128 DISPLAY ON DAY   16

.       .       .       .       .       .       .       .       .       .       .
8       9       0       1       2       3       4       5       6       7       8
01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
        SSSSS
           SS
                  FFFFFFFFFFFF
                              V
                             SS
                              SSSSS
                                  UU
                                  UUU
                                   UUU
                                    UU
                                     UUU
                                        UUUUUU
                                             UU
                                              U
```

TASK WUC	STOP TIME	NO. PREM
PREFLT	16.94	0
PRELCH	16.95	0
SORTIE	17.11	0
DCRMNT	17.11	0
FUEL	17.12	0
POSFLT	17.16	0
CMDISP	17.17	0
TSHOOT	17.18	0
CMTSHT	17.20	0
MNREP1	17.20	0
REMVC1	17.22	0
BCHKC1	17.27	0
TRANC1	17.27	0
REPLC1	17.27	0

FIGURE A-9. S.P. 3.5's SAMPLE A/C DISPLAY (HIS).

MISSION SUCCESS STATISTICS RUN NUMBER SP3.5U PAGE 94

LEVEL 3 REPORT FROM .1 TO 60.0

MISSION IDENT	TIME SCHED	SIZE MAX	SIZE MIN	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	PCT	TAKEOFF LATE	PCT
PREFLT	300	16	0	2	2	1.000	32	32	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	17	0	42	42	1.000	714	714	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	18	0	4	4	1.000	72	72	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	19	0	12	12	1.000	228	228	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	600	2	2	60	60	1.000	120	120	1.000	0	0	0	0	0	0	0	2	.017	0	0.
INTRD3	700	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	800	4	3	60	60	1.000	240	240	1.000	0	0	0	0	2	0	0	0	0.	0	0.
INTRD1	830	2	2	60	60	1.000	120	120	1.000	1	2	0	0	0	0	57	1	.008	0	0.
RECON	1000	2	2	60	60	1.000	120	120	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY1	1030	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRD1	1230	2	2	60	60	1.000	120	120	1.000	3	16	0	0	0	0	41	11	.092	4	.033
CLSPT1	1320	3	2	60	60	1.000	180	173	.961	0	7	0	0	0	0	0	0	0.	0	0.
INTRD2	1400	2	2	60	60	1.000	120	120	1.000	2	21	0	0	2	0	37	42	.350	6	.050
RECON	1500	2	2	60	60	1.000	120	120	1.000	0	22	0	0	0	0	38	57	.558	8	.067
RECON	1600	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	5	.083	2	.033
RECON	1800	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2000	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2200	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY2	2400	2	2	59	59	1.000	118	118	1.000	0	0	0	0	0	0	0	0	0.	0	0.

MISSION SUCCESS STATISTICS RUN NUMBER SP3.5U PAGE 95

LEVEL 3 SUMMARY REPORT FROM .1 TO 60.0

MISSION IDENT	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	DAYLIGHT SORTIES ATTD	PCT	DAYLIGHT SORTIES FLOWN	PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	PCT	TAKEOFF LATE	PCT
PREFLT	60	60	1.000	1046	1046	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.
RECON	420	420	1.000	600	600	1.000	420	.700	420	.700	0	22	0	0	0	0	38	74	.123	10	.017
INTRD3	60	60	1.000	60	60	1.000	60	1.000	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	60	60	1.000	240	240	1.000	240	1.000	240	1.000	0	0	0	0	2	0	0	0	0.	0	0.
INTRD1	120	120	1.000	240	240	1.000	240	1.000	240	1.000	4	18	0	0	0	0	98	12	.050	4	.017
FERRY1	60	60	1.000	60	60	1.000	60	1.000	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT1	60	60	1.000	180	173	.961	180	1.000	173	1.000	0	7	0	0	0	0	0	0	0.	0	0.
INTRD2	60	60	1.000	120	120	1.000	120	1.000	120	1.000	2	21	0	0	2	0	37	42	.350	6	.050
FERRY2	59	59	1.000	118	118	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.

FIGURE A-10. S.P. 3.5's MISSION POST PROCESSOR OUTPUT (HIS).

MODEL SUPPORT EQUIPMENTS DEMANDS

RESOURCE ID 10 ON -EQUIPMENT

```
4 +                                                
```

ACTUAL SUPPORT EQUIPMENT DEMANDS

RESOURCE ID 18 ON -EQUIPMENT

```
 4 +                                                
```

V. Standard Systems Release (CDC)

Version 3.5E, dated 12 October 1979, is the systems release herein described.

A. Systems Release Tape

The seven track tape (nine track, if necessary) provided for the LCOM II System Release contains all the necessary program and data files for system implementation and initial checkout with sample problem #3.5. In the write-up and listings that follow, all file and tape names are recommended names for consistency of descriptions permanent file sizes given are appropriate sizes required for the initial checkout runs. Unless you have several thousand PRU's of permanent file space available, you should put the large test files on magnetic tape.

B. Release Tape File Descriptions

File #	Description	Permanent File Name	Permanent File Size
1	Input Module Object	INPTOBJ	509 PRU's
2	Main Module Object	MAINOBJ	1001
3	Pack-Unpack Object	PACKOBJ	3
4	Decoder Object	DCDROBJ	124
5	Parts Post Processor Object	PRTSOBJ	40
6	Graph Post Processor Object	GRPHOBJ	53
7	Matrix Post Processor Object	MTRXOBJ	251
8	Display Post Processor Object	DPLYOBJ	36
9	Mission Post Processor Object	MSNOBJ	187
10	Support Equipment Post Processor Object	SEQOBJ	59
11	Input Module Data (Sample Problem #3.5)	SP3DATA	39
12	Main Module Change Card Data (Unconstrained)	CHNGUNC	8
13	Main Module Change Card Data (Constrained)	CHNGCON	8

C. Additional Files Needed to Make the Sample Problem #3.5 Full Systems Test

Description	File Name	Size
60-Day Exogenous File (produced by Input Module)	SP3EXOG	242
Initialization File (produced by Input Module)	SP3INIT	57
Unconstrained Main Module Output	SP3UNC	10680
Constrained Main Module Output	SP3CON	10544
Graph Data (produced by Decoder)	SP3GRPH	66
Parts Dictionary (produced by Decoder)	SP3PDIC	1
Parts Data (produced by Decoder)	SP3PRTS	928
Matrix Dictionary (produced by Decoder)	SP3MDIC	1
Matrix Data (produced by Decoder)	SP3MTRX	5848
Realized Flying Schedule Data (produced by Decoder)	SP3RFS	536
Support Equipment Data (produced by Decoder)	SP3SEQ	400
Display Data (produced by Decoder)	SP3DPLY	38

D. Run Control Cards

1. The job streams necessary to copy the LCOM II system release tape to permanent files and conduct test runs are described in the chart below and are included in Table A-2. Figure A-13 contains charts showing the interfaces among runs 3 to 11. The file names used in these charts and listings relate to the file names specified in paragraphs B and C.

Run #	Description
1	Job that copies LCOM permanent disc files to the Systems Release Tape.
2	Job that copies the tape files to permanent disc files.
3	Input Module run of sample problem #3.5.
4	Main Module run (Unconstrained) using data produced by Run 3.
5	Decoder run using data from Run 4.
6	Parts Post Processor using data from data from Run 5.
7	Graph Post Processor using data from Run 5.
8	Matrix Post Processor using data from Run 5.
9	Display Post Processor using data from Run 5.
10	Mission Post Processor using data from Run 5.
11	Support Equipment Post Processor using data from Run 5.

2. Note: Of course, you must substitute your own job names, tape VSNs, owner identifications, and other changes to these runs to satisfy your local system requirements. For instance, the CDC system at ASD at WPAFB requires an owner ID after the period on the job card but does not require an owner ID on the permanent file control cards if they apply to the ID on the job card.

E. Description of Test Runs and Results (for checkout purposes)

1. Run #1 - System copy to tape - performed by AFMSMET only.

2. Run #2 - Copy Systems Release Tape on to disc files - users initial run.

3. Run #3 - Input Module.

a. Legal warning and information messages will be found throughout the listing. The message # and quantity found are as follows (#/Qty); 41/1, 144/7, 140/1, 20/1, 67/1, 16/1, 17/1, 24/1 (None), 36/1 (None), 11/1 (None), 96/1 (7 entries), 97/1 (None), 79/1 (None), 80/1 (None), 4/1 (1 entry), 146/1 (None), 147/1 (None), 117/1 (None), 31/1 (1 entry), 53/1. Also, with the SPEC card option INFO=3, the node range report (MSG 17) will be printed in full.

b. Total sorties generated by Mission Type (report):

MSNAME	NO. MISSIONS	NO. SORTIES	FLYING HOURS
PREFLT	60	60	0.
RECON	420	600	480.000
INTRD1	120	240	368.479
CLSPT1	60	180	130.271
CLSPT2	60	240	362.256
INTRD2	60	120	179.074
INTRD3	60	60	60.000
FERRY1	60	60	126.834
FERRY2	60	120	251.902

c. Input Data Summary (report):

Qty	Description
23	Resources
96	Task Names
130	Node Names
163	Control Table Entries
11	Failure Clocks
9	Mission Entry Points (IETB)
3	Resources Entering Network (NACO)
6	Total # of Configurations Defined (All A/C) NCRS)
9	Search Patterns (NSRPT)
13	Next Higher Failures (NNHF)
70	Task Resource Requirements (TRR)
9	Unique Groups of Clock Decrements (NOCL)
1	Unique Pieces of Internal Equipment (EQUIP)
2	Internal Equipment Groups (ILIST)
2	Triggering Events (NTEVT.DV)
9	Operations Headings on Form 10
3	Aircraft Headings on Form 10
10	Personnel Headings on Form 10
10	Part Headings on Form 10
2	AGE Headings on Form 10

d. To insure full preparation of an initialization file, two messages must follow the printing of the dictionaries. These messages are as follows and may be separated by a printout of the entire initialization file data.

. MAIN MODEL INIT IS TO BE PRODUCED

. LEGITIMATE END MARKER READ

4. Run #4 - Main Module Run (Unconstrained):

This new sample problem #3.5 does not provide a fully unconstrained run. The applicable camera technicians are slightly constrained and the pre-sortie time line for internal reconfigurations may require adjustment to permit an unconstrained 100% flying support. It is expected that future versions of this sample problem will again produce truly unconstrained run results.

a. Unconstrained Run

(1) From the Level II day 10-60 Performance Summary Report, the following selected statistics/total values are given:

#	Statistic	Value
3	Percent accomplished	99.60
8	Percent accomplished	98.81
T4	Number of attritions	5.00
T5	Number of RAM Repairs	1.00
23	Avg No. of Sorties/aircraft/day	1.37
24	Flying Hours	1612.07
33	Number of Men Demanded	32455.00
40	Simulated MH Per Flying Hour	11.81
44	No. of Reparable Generations	6612.00
57	Number of Units Demanded	6771.00
75	Number of Units Demanded	1094.00

(2) From the end of run Stop Report at time 100.01; Total Jobs Started = 57083, Total Jobs Completed = 57083, Total Jobs Preempted = 0.

b. Constrained Run

(1) From the Level II day 10-60 Performance Summary Report, the following selected statistics total values are given:

#	Statistics	Value
3	Percent accomplished	90.93
8	Percent accomplished	88.74
T4	Number of attritions	3.00
T5	Number of RAM Repairs	4.00
23	Avg No. of Sorties/aircraft/day	1.17
24	Flying Hours	1440.13
33	Number of Men Demanded	29918.00
40	Simulated MH Per Flying Hour	12.22
44	No. of Reparable Generations	5971.00
57	Number of Units Demanded	6118.00
62	Number of Cannibalizations	4.00
75	Number of Units Demanded	1011.00

(2) From the end of run Stop Report at time 100.01; Total Jobs Started = 52744, Total Jobs Completed = 52706, Total Jobs Preempted = 38.

5. Run #5 - Decoder Run (Unconstrained):

A two-page report is printed as shown in Figure A-14. For runs 5-11, no constrained run results will be given.

6. Run #6 - Parts Sort and Parts Post Processor (Unconstrained).

a. Parts Sort - Records Sorted = 11813.

b. See Figure A-15 for run results.

7. Run #7 - Matrix Sort and Matrix Post Processor (Unconstrained).

a. Matrix Sort - Records Sorted = 93533.

b. See Figure A-19 for one set of matrices (two parts) printed in the run.

8. Run #8 - Graph Post Processor (Unconstrained).

a. See Figure A-16 for statistic value printouts.

b. See Figure A-17 for Histogram of post sortie aircraft turnaround times.

c. See Figure A-18 for graph of Stat 22 (avg aircraft Post Sortie Time (hrs)).

9. Run #9 - Display Post Processor (Unconstrained). See Figure A-20 for the first full display of each aircraft displayed (Day 0 and Day 16).

10. Run #10 - Mission Post Processor (Unconstrained): See Figure A-21 for the final level 3 Mission Statistics Summary Report.

11. Run # 11 - Support Equipment Post Processor (Unconstrained): See Figure A-22 for the Model on-equipment demands for resource truck and Figure A-23 for the Actual on-equipment demands.

F. SIMSCRIPT II Systems Release

All installations using CDC LCOM II are responsible for obtaining their own SIMSCRIPT II.5 compiler maintenance. Latent errors found in the final release of the Navy Compiler make a subsequent release under a GSA maintenance contract a preferred compiler for use with the LCOM II system. As such, AFMSMET will ensure complete LCOM II operation on the latest release of the CDC SIMSCRIPT II.5 compiler. AFMSMET can provide absolute files to those government installations where there is no SIMSCRIPT II.5 compiler. However, any computer system software differences that prevent the SIMSCRIPT II execution library from functioning will preclude AFMSMET's support to such installations.

G. System Improvements - Included in IV.H.

H. Error Corrections (from previous versions) - Included in above.

I. Known Errors - Included in IV.J.

TABLE A-2 CDC RELEASE 3.5 RUNS - JCL

Run #2 Job Stream to Copy Tape Files to Permanent Disc Files

```
XXXXX,MT1,I0200.
REQUEST,TAPE,MT,HY,VSN=XXXXX,NORING.
REQUEST,INPTOBJ,*PF.
COPYBF,TAPE,IOPTOBJ.
CATALOG,INPTOBJ,RP=999,ID=X.
REQUEST,MAINOBJ,*PF.
COPYBF,TAPE,MAINOBJ.
CATALOG,MAINOBJ,RP=999,ID=X.
REQUEST,PACK,*PF.
COPYBF,TAPE,PACK.
CATALOG,PACK,RP=999,ID=X.
REQUEST,DCDROBJ,*PF.
COPYFB,TAPE,DCDROBJ.
CATALOG,DCDROBJ,RP=999,ID=X.
REQUEST,PRTSOBJ,*PF.
COPYFB,TAPE,PRTSOBJ.
CATALOG,PRTSOBJ,RP=999,ID=X.
REQUEST,GRPHOBJ,*PF.
COPYFB,TAPE,GRPHOBJ.
CATALOG,GRPHOBJ,RP=999,ID=X.
REQUEST,MTRXOBJ,*PF.
COPYBF,TAPE,MTRXOBJ.
CATALOG,MTRXOBJ,RP=999,ID=X.
REQUEST,DPLYOBJ,*PF.
COPYBF,TAPE,DPLYOBJ.
CATALOG,DPLYOBJ,RP=999,ID=X.
REQUEST,MSNOBJ,*PF.
COPYBF,TAPE,MSNOBJ.
CATALOG,MSNOBJ,RP=999,ID=X.
REQUEST,SEQOBJ,*PF.
COPYBF,TAPE,SEQOBJ.
CATALOG,SEQOBJ,RP=999,ID=X.
REQUEST,SP3DATA,*PF.
COPYBF,TAPE,SP3DATA.
CATALOG,SP3DATA,RP=999,ID=X.
REQUEST,CHNGUNC,*PF.
COPYBF,TAPE,CHNGUNC.
CATALOG,CHNGUNC,RP=999,ID=X.
REQUEST,CHNGCON,*PF.
COPYBF,TAPE,CHNGCON.
CATALOG,CHNGCON,RP=999,ID=X.
6/7/8/9
```

TABLE A-2 CDC RELEASE 3.5 RUNS - JCL

Run #3 Input Module Run of Sample Problem

```
XXXXX,CM120000,T20,I020.
ATTACH,LGO,INPTOBJ,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,SIMU11,SP3DATA,ID=X.
REQUEST,SIMU7,*PF.
REQUEST,SIMU9,*PF.
LGO.
CATALOG,SIMU7,SP3INIT,RP=30,ID=X.
CATALOG,SIMU9,SP3EXOG,RP=30,ID=X.
7/8/9
SPEC FORM=11  INFO=3
```

Note: The CDC SIMSCRIPT II.5 compiler requires that the local file names of all input and output files be of the Form SIMUX, where X is the file number. Also, odd file numbers must be used where necessary to drop the slewing (carriage control) commands from an output file. Normally, you must drop slewing commands on files that are going to another program rather than to the printer.

Run #4 Main Module Run (Unconstrained)

```
XXXXX,CM205000,T600,I0100,MT1.
ATTACH,SIMU11,CHNGUNC,ID=X.
ATTACH,LGO,MAINOBJ,ID=X.
ATTACH,PACK,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,SIMU7,SP3INIT,ID=X.
ATTACH,SIMU9,SP3EXOG,ID=X.
REQUEST,SIMU3,MT,HY,VSN=XXXXX,RING.  (SP3CON or SP3UNC)
LOAD,LGO,PACK.
EXECUTE.
7/8/9
SPEC CHNG=11  INIT=7  EXOG=9  POST=3
6/7/8/9
```

TABLE A-2 CONT'D

Run #5 Decoder Run Using Data from Run #4

```
XXXXX,CM54000,T300,I0200,MT1.
ATTACH,LGO,DCDROBJ,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
REQUEST,SIMU1,MT,HY,VSN=XXXXX,NORING.  (SP3CON or SP3UNC)
REQUEST,SIMU3,*PF.
REQUEST,SIMU7,*PF
REQUEST,SIMU9,*PF.
REQUEST,SIMU13,*PF.
REQUEST,SIMU15,*PF.
REQUEST,SIMU17,*PF.
REQUEST,SIMU19,*PF.
REQUEST,SIMU21,*PF.
LGO.
CATALOG,SIMU3,SP3GRPH,ID=X,PR=30.
CATALOG,SIMU7,SP3MDIC,ID=X,RP=30.
CATALOG,SIMU9,PS3MTRX,ID=X,RP=30.
CATALOG,SIMU13,SP3DPLY,ID=X,RP=30.
CATALOG,SIMU15,SP3PDIC,ID=X,RP=30.
CATALOG,SIMU17,SP3PRTS,ID=X,RP=30.
CATALOG,SIMU19,SP3SEQ,ID=X,RP=30.
CATALOG,SIMU21,SP3RFS,ID=X,RP=30.
7/8/9
SPEC IN=1  GRPD=3  MTRX=7  MBCD=9  DPLY=13  PRTS=15  PBCD=17
   SEQ=19  RFS=21  *
6/7/8/9
```

Run #6 Parts Post Processor Using Data from Run #5

```
XXXXX,CM60000,T40,I050.
ATTACH,PBCD,SP3PRTS,ID=X.
REQUEST,SIMU1,*PF.
FILE,PBCD,BT=C,RT+Z,FL=80.
FILE,SIMU1,BT=C,RT=Z,FL=80.
SORTMRG.
REWIND,SIMU1.
ATTACH,LGO,PRTSOBJ,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,SIMU3,SP3PDIC,ID=X.
LGO.
7/8/9.
SORT
FILE,INPUT=PBCD,OUTPUT=SIMU1
FIELD,PART(1,6,DISPLAY),TIME(7,10,DISPLAY)
KEY,PART(A,COBOL6),TIME(A,COBOL6)
END
7/8/9
SPEC IN=1  DICT=3  DAYS=60
6/7/8/9
```

Run #7 Graph Post Processor Using Data from Run #5

```
XXXXX,CM60000.
ATTACH,LGO,GRPHOBJ,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,SIMU1,SP3GRPH,ID=X.
LGO.
7/8/9
SPEC DAYS=10  STAT=6  STRT=0  STOP=60
3  6  24  34  41  53  *
6/7/8/9
```

TABLE A-2 CONT'D

Run #8 Manpower Matrix Post Processor Using Data from Run #5

```
XXXXX,CM70000,T300,I0300.
REQUEST,SIMU9,SP3MTRX,ID=X.
REQUEST,SIMU1,*PF.
FILE,SIMU9,BT=C,RT=Z,FL=80.
FILE,SIMU1,BT=C,RT=Z,FL=80.
SORTMRG.
REWIND,SIMU1.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,LGO,MTRXOBJ,ID=X.
ATTACH,SIMU3,SP3MDIC,ID=X.
LGO.
7/8/9
SORT
FILE,INPUT=SIMU9,OUTPUT=SIMU1
FIELD,RCD(1,1DISPLAY),CWC(2,4,DISPLAY),TIME(6,10,DISPLAY)
KEY,CWC(A,COBOL6),RCD(A,COBOL6),TIME(A,COBOL6)
END
7/8/9
SPEC IN=1  DICT=3 NUM=9  STOP=60  NBLK=2  BLK1=5  BLK2=2  STRT=10 *
CREWCH1253000816
CREWCH2253000816
OMPERS1253000816
OMPERS2253000816
FLTENG1253000816
FLTENG2253000816
HYDTEC1253000816
HYDTEC2253000816
HYDSPL1253000816
HYDSPL2253000816
COMTEC1253000816
COMTEC2253000816
COMSPL1253000816
COMSPL2253000816
MUNSPL1253051321
MUNSPL2253051422
CAMTEC1253051422
CAMTEC2253051422
6/7/8/9
```

TABLE A-2 CONT'D

Run #9 Display Post Processor Using Data from Run #5

```
XXXXX,CM44000.
ATTACH,LGO,DPLYOBJ,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,SIMU1,SP3DPLY,ID=X.
LGO.
7/8/9
SPEC IN=1
6/7/8/9
```

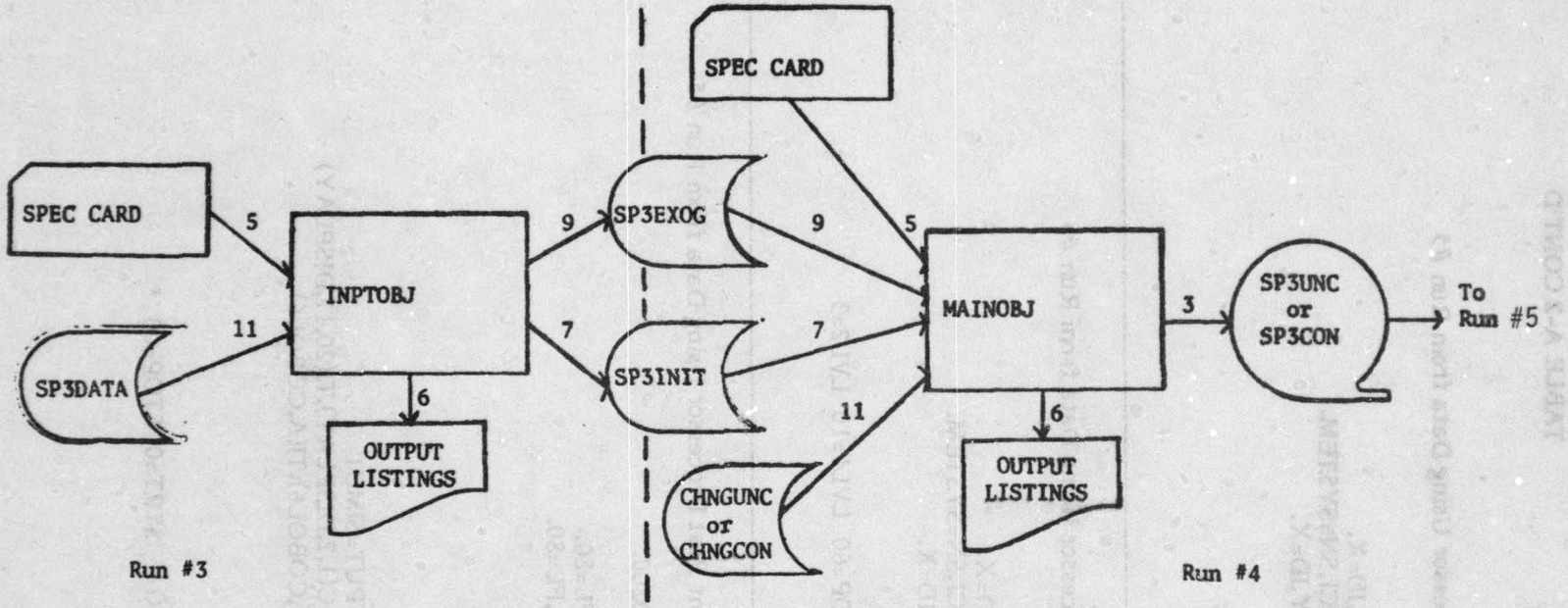
Run #10 Mission Post Processor Using Data from Run #5

```
XXXXX,CM55000.
ATTACH,LGO,MSNOBJ,ID=X.
ATTACH,SIM2LIB,ID=CACI,SN=SYSTEM.
ATTACH,SIMU9,SP3RFS,ID=X.
LGO.
7/8/9
SPEC IN=9  STRT=10  STOP=60  LVL1=10  LVL2=3
6/7/8/9
```

Run #11 Support Equipment Post Processor Using Data from Run #5

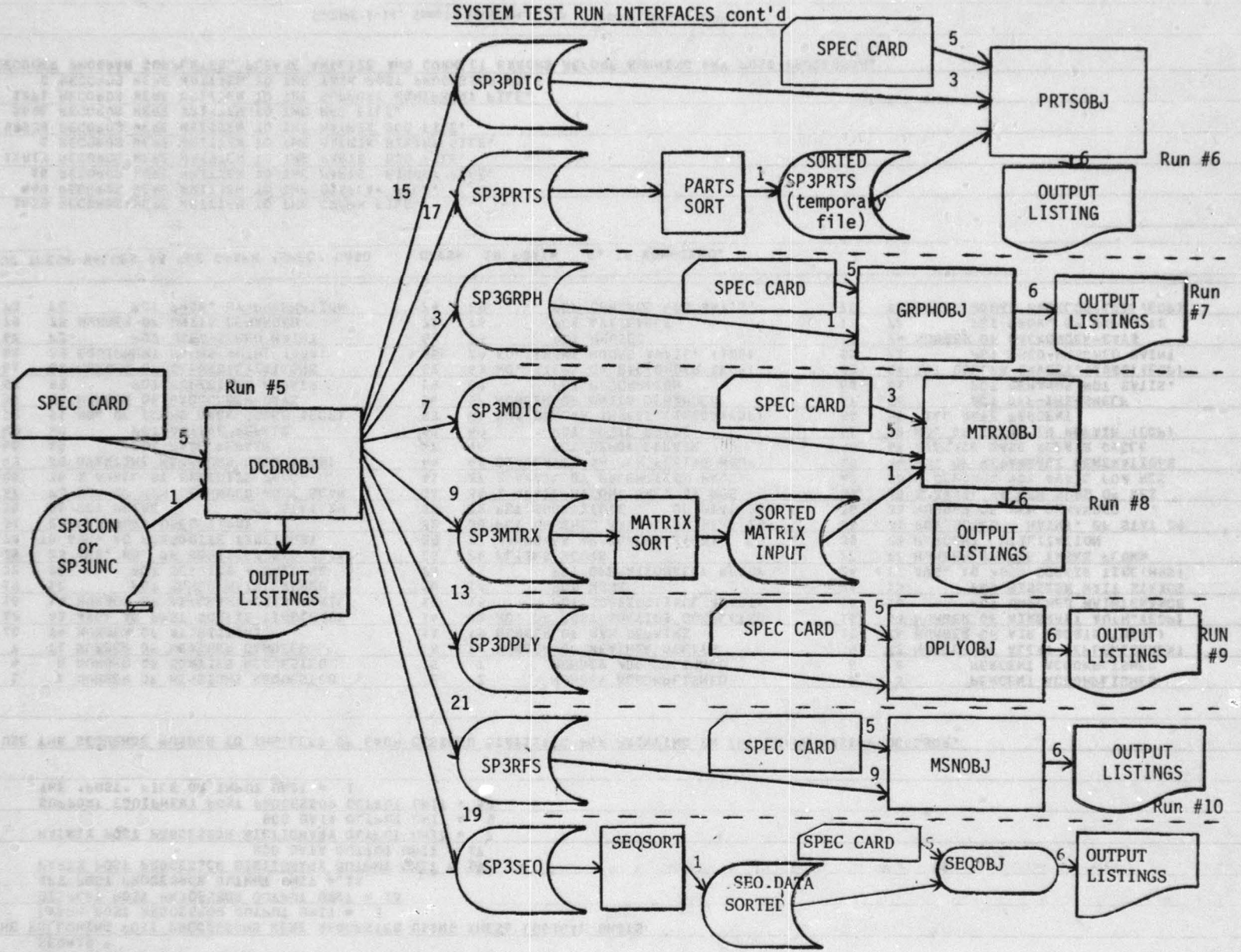
```
XXXXX,CM70000,T100,IO200.
ATTACH,SP3SEQ,ID=X.
FILE,SIMU1,BT=C,RT=Z,FL=80.
FILE,SP3SEQ,BT=C,RT=Z,FL=80.
SORTMRG.
REWIND,SIMU1.
ATTACH,LGO,SEQOBJ.
LGO.
7/8/9
SORT
FILE,INPUT=SP3SEQ,OUTPUT=SIMU1
FIELD,ID(4,6,DISPLAY),RC(1,2,DISPLAY),TI(20,11,DISPLAY)
KEY,ID(A,COBOL6),RC(A,COBOL6),TI(A,COBOL6)
SEQUENCE,COBOL6
EQUATE,COBOL6( ,0)
END
7/8/9
SPEC  IN=1  NUM=1  DBUG=1  STRT=0  STOP=60 *
  10
7/8/9
```

FIGURE A-13 SYSTEM TEST RUN INTERFACES (CDC)



Note: The numbers shown near the individual files are those used in the system test and assigned through the SPEC card for that run.

SYSTEM TEST RUN INTERFACES cont'd



```
                                    LCOM11 STANDARD VERSION  CDC  RELEASE  3.5.1
SPEC IN=1 MTRX=7 MBCD=9 GRPD=3 DPLY=13 PRTS=15 PBCD=17 RFS=11
     SEQ=19 *
THE FOLLOWING POST PROCESSORS WERE REQUESTED USING THESE LOGICAL UNITS
     GRAPH POST PROCESSOR OUTPUT UNIT =  3
     DISPLAY POST PROCESSOR OUTPUT UNIT = 13
     RFS POST PROCESSOR OUTPUT UNIT = 11
     PARTS POST PROCESSOR DICTIONARY OUTPUT UNIT = 15
                          BCD DATA OUTPUT UNIT = 17
     MATRIX POST PROCESSOR DICTIONARY OUTPUT UNIT =  7
                           BCD DATA OUTPUT UNIT =  9
     SUPPORT EQUIPMENT POST PROCESSOR OUTPUT UNIT = 19
     THE 'POST' FILE OR INPUT UNIT =  1

USE THE SEQUENCE NUMBER TO THE LEFT OF EACH DESIRED STATISTIC FOR PRINTING IN THE GRAPH POST PROCESSOR.

  1    1 NUMBER OF MISSIONS REQUESTED          2    2       NUMBER ACCOMPLISHED          3    3       PERCENT ACCOMPLISHED
  4    6 NUMBER OF SORTIES REQUESTED           5    7       NUMBER ACCOMPLISHED          6    8       PERCENT ACCOMPLISHED
  7   T1 NUMBER OF WEATHER CANCELS             8   T2 NUMBER OF WEATHER DELAYS          9   T3 NUMBER OF ALERT REPLENISHMENT
 10   T4 NUMBER OF ATTRITIONS                 11   T5 NUMBER OF RAM REPAIRS            12   T6 NUMBER OF AIR ABORTS(TOTAL)
 13   A1 AVG. AC POST SORTIE TIME(HRS)        14   A2 NO. OF POST-SORTIES COMPLETED    15   13 NUMBER OF AIRCRAFT AUTH.(EOP)
 16   14 NUMBER OF AIRCRAFT-DAYS AVAIL        17   15       PCT SORTIES(INCL ALERT)     18   16       PCT UNSCHED MAINTENANCE
 19   17       PCT SCHED MAINTENANCE          20   18       PCT NORS                    21   19       PCT MISSION WAIT STATUS
 22   20       PCT SERVICE + WAITING          23   21       PCT OPERATIONALLY READY     24   22 AVG. AC POST SORTIE TIME(HRS)
 25   23 AVG. NO. OF SORTIES/ A/C /DAY        26   24 FLYING HOURS                      27   T7 NUMBER OF FCF TASKS FLOWN
 28   T8 AVG. AC PRESORTIE TIME(HRS)          29   27 MANHOURS AVAILABLE (100)          30   28 PERCENT  UTILIZATION
 31   29 MANHOURS USED (100)                  32   30 PCT UNSCHED MAINT. OF STAT 29     33   31 PCT SCHED  MAINT. OF STAT 29
 34   P1 PCT PRIME          OF STAT 29        35   P2 PCT SUBSTITUTE    OF STAT 29      36   33 NUMBER OF MEN DEMANDED
 37   P3 NBR OF MEN DEMANDED POST SCAN        38   34 % AVAIL BY OH. BAL. OF RES        39   35 % AVAIL BY GEN SUBS OF RES
 40   36 % AVAIL BY EXPEDITE PROC.            41   37 % AVAIL BY PREEMPTION PROC.       42   38 % DEMANDS NOT AVAIL FOR RES
 43   39 OVERTIME MANHOURS USED (100)         44   40 SIMULATED MH PER FLYING HOUR      45   44 NO. OF REPARABLE GENERATIONS
 46   45       PCT BASE REPAIR                47   46       PCT DEPOT REPAIR            48   47 AVERAGE BASE REPAIR CYCLE
 49   48       PCT ACTIVE REPAIR              50   49       PCT WHITE SPACE             51   50 NO. OF ITEMS IN REPAIR (EOP)
 52   51 NO. OF ITEMS BACKLOGGED (EOP)        53   54 TOT DOLLAR INVEST.(1000)(EOP)     54   55 FILL RATE PERCENT
 55   56 NUMBER OF BACKORDER-DAYS             56   57 NUMBER OF UNITS DEMANDED          57   58       PCT OFF-THE-SHELF
 58   59       PCT EXPEDITED REPAIR           59   60       PCT PREEMPTION              60   61       PCT DEMANDS NOT SATIS.
 61   62 NUMBER OF CANNIBALIZATIONS           62   63 NO. ITEMS ON BACKORDER (EOP)      63   68 TOT DOLLAR INVEST.(1000)(EOP)
 64   69 EQUIPMENT HOURS AUTH. (100)          65   70 EQUIPMENT HOURS AVAIL. (100)      66   71       PCT USED-UNSCHED MAINT
 67   72       PCT USED-SCHED MAINT           68   73       PCT UNUSED                  69   74 NUMBER OF BACKORDER-DAYS
 70   75 NUMBER OF UNITS DEMANDED             71   76       PCT AVAILABLE               72   77       PCT PROV. BY EXPEDITE
 73   78       PCT PROV. BY PREEMPTION        74   79       PCT DEMANDS NOT SATIS.      75   80 EQUIP HOURS BACKLOG(100)(EOP)

PUT THESE VALUES ON THE GRAPH 'SPEC' CARD     DAYS=  10 FDAY=   0, IF NON-ZERO.

  1609 RECORDS WERE WRITTEN TO THE GRAPH FILE.
   449 RECORDS WERE WRITTEN TO THE DISPLAY FILE.
    10 RECORDS WERE WRITTEN TO THE PARTS  BINARY FILE.
 11813 RECORDS WERE WRITTEN TO THE PARTS  BCD FILE.
     1 RECORDS WERE WRITTEN TO THE MATRIX BINARY FILE.
 93533 RECORDS WERE WRITTEN TO THE MATRIX BCD FILE.
  5696 RECORDS WERE WRITTEN TO THE RFS FILE.
  1271 RECORDS WERE WRITTEN TO THE SUPPORT EQUIPMENT FILE.
     0 RECORDS WERE WRITTEN TO THE TASK POST PROCESSOR FILE.
DECODER PROGRAM COMPLETED. PLEASE ANALIZE AND CORRECT ERRORS BEFORE RUNNING ANY POST PROCESSOR.
```

FIGURE A-14. Sample Problem 3.5's Decoder Output (CDC)

PART NUC	STANDARD STATISTICS UNIT COST	AUTHORIZED LEVEL	AVG QUAN ON HAND	MIN QUAN ON HAND	NO. DEMANDS	AVG DAILY DEMAND	DEMDS NOT SATIS.	TIME BETWN DEMDS	# DAYS STOCK OUT	# DAYS BACKORDER	BACKORDER RATE	BASE STATISTICS NO. REPAIRED	NO. CONDEMNED	CONDEMNED RATE	AV DECISION TIME	MAX CYCLE TIME	AVG CYCLE TIME	STD DEV C-TIME	DEPOT STATISTICS NO. REPAIRED	NO. CONDEMNED	CONDEMNED RATE	BASE NRTS RATE	MAX CYCLE TIME	AVG CYCLE TIME	STD DEV C-TIME
PUMPH1	$ 100.00		99	96.7400	19	.3167	0	3.098813	0.	0.	%	14	0	0.	.010891	1.661026	.986387	.487668	5	0	0.	26.316	27.350183	24.664208	2.718708
PUMPH2	$ 100.00		99	93.9374	75	1.2500	0	.778287	0.	0.	%	67	0	0.	.010676	2.909668	2.018965	.481935	8	0	0.	10.667	32.146887	21.128299	5.210575
RDASSY	$ 1000.00		99	97.5608	1164	19.4000	0	.051425	0.	0.	%	1164	0	0.	.010403	.115092	.081137	.007020	0	0	0.	0.	0.	0.	0.
RADC11	$ 500.00		299	218.9771	755	12.5833	0	.079854	0.	0.	%	513	0	0.	.010463	.107786	.074031	.011221	242	0	0.	32.053	36.682572	19.705176	5.828173
RADC12	$ 500.00		299	255.4021	767	12.7833	0	.078085	0.	0.	%	644	0	0.	.010449	.089822	.073072	.004401	123	0	0.	16.037	34.556698	20.926874	5.865282
MISSSD	$ 1000.00		9999	9326.9300	3472	57.8667	0	.017067	0.	0.	%	186	0	0.	0.	0.	0.	0.	3278	0	0.	94.630	0.	0.	0.
SMTBMS	$ 18000.00		9999	9754.2179	1200	20.8000	0	.049222	0.	0.	%	0	0	0.	0.	0.	0.	0.	1197	0	0.	100.000	0.	0.	0.
MISSLS	$ 14000.00		999	893.8849	544	9.0667	0	.108729	0.	0.	%	75	0	0.	0.	0.	0.	0.	441	0	0.	85.465	0.	0.	0.
CAMERA	$ 2600.00		99	101.5377	103	1.7167	0	.578758	0.	0.	%	103	0	0.	0.	.080113	.062568	.006505	0	0	0.	0.	0.	0.	0.

FIGURE A-15. S.P. 3.5's PART POST PROCESSOR OUTPUT (CDC)

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```
GRAPHING SPECIFICATIONS
THE VALUE OF EACH X-COORDINATE ON THE GRAPHS IS PRINTED SUCH THAT THE RIGHT
MOST DIGIT IS PRINTED UNDER THE CORRESPONDING X-COORDINATE (* OR PSR POINT).
WHEN THE STATISTICS ARE GRAPHED THE NUMBER OF PAGES NEEDED TO GRAPH EACH
STATISTIC WILL DEPEND ON THE NUMBER OF PSR'S THAT ARE WITHIN THE STRT - STOP INTERVAL.

                1 - 30 PSR POINTS     1 PAGE          3 X-AXIS SPACES BETWEEN PSR POINTS
               31 - 60 PSR POINTS     1 PAGE          1 X-AXIS SPACE BETWEEN PSR POINTS
               61 - MAX PSR POINTS    MAX/60 PAGES    1 X-AXIS SPACE BETWEEN PSR POINTS

SPEC DAYS=10 STAT=5 STRT=1 STOP=60 IN=3
THE STATISTICS TO BE GRAPHED
 3
 6
24
34
41
53
FORECAST STATISTICS WILL NOT BE GRAPHED.
```


FIGURE A-16. S.P. 3.5's GRAPH STAT VALUE PRINTOUT(CDC)

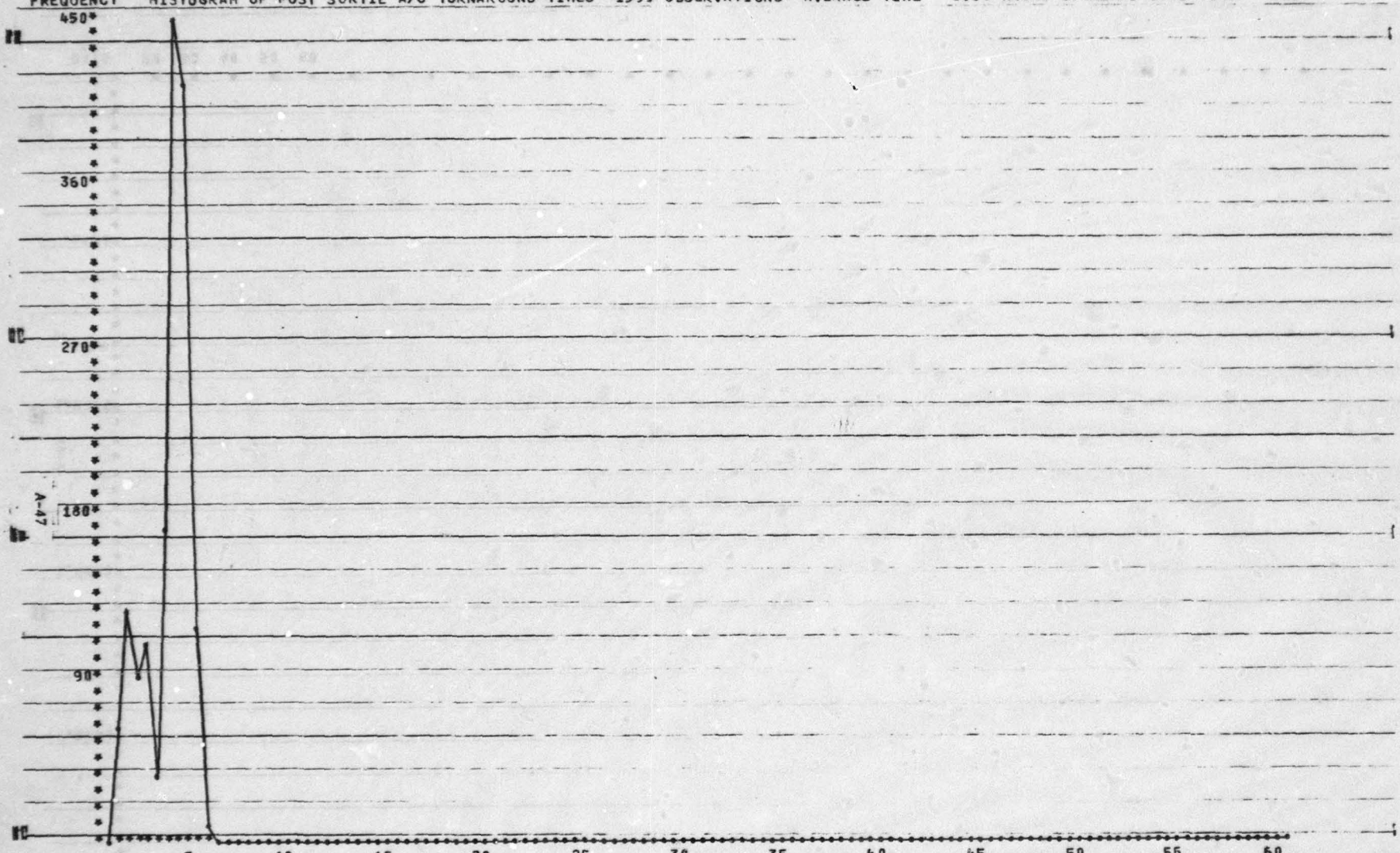


FIGURE A-17. S.P. 3.5's POST SORTIE TURNAROUND HISTOGRAM

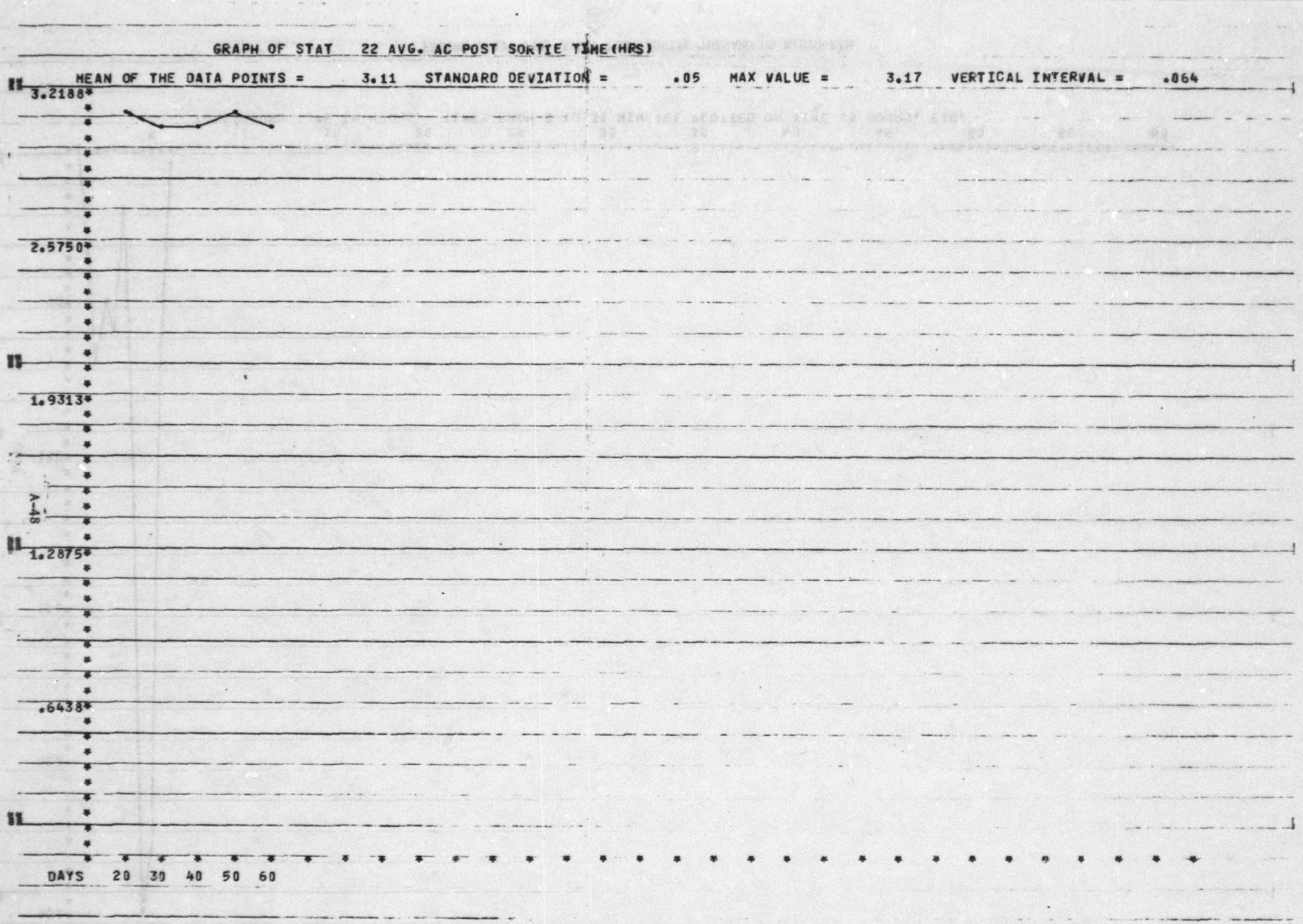
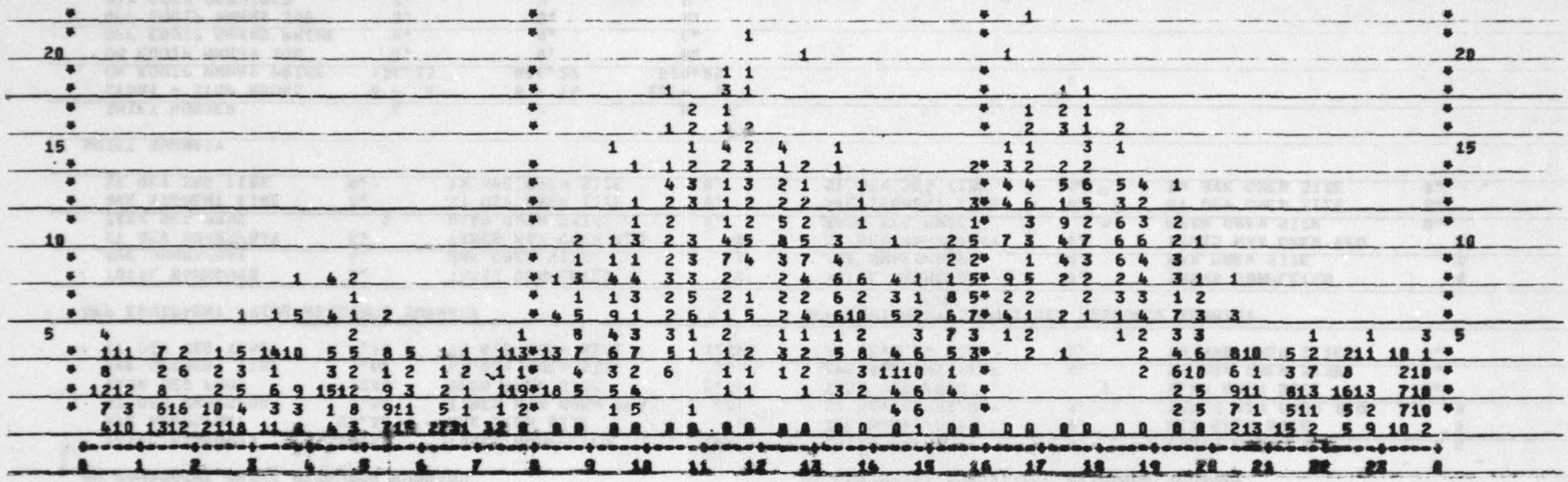


FIGURE A-18. S.P. 3.5's GRAPH OF STAT 22 (CDC)

PRODUCTIVE UTILIZATION MATRIX FOR RESOURCE COMTEC (7)



ON EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	3284.78	TASKS COMPLETED	3113
AVE MNHRS/DAY	91.24	MAX CREW SIZE	2
ST DEV MNHRS/DAY	10.27	TIMES MAX CREW REQ	1717
TASK SEG PROC	3113	MEAN CREW SIZE	1.55
AVE SEGMENT TIME	.67	ST DEV CREW SIZE	.50
ST DEV SEG TIME	.37	TM AVE CREW SIZE	1.58

ON EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TM AVE CREW SIZE	0.

OFF EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TM AVE CREW SIZE	0.

OFF EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TM AVE CREW SIZE	0.

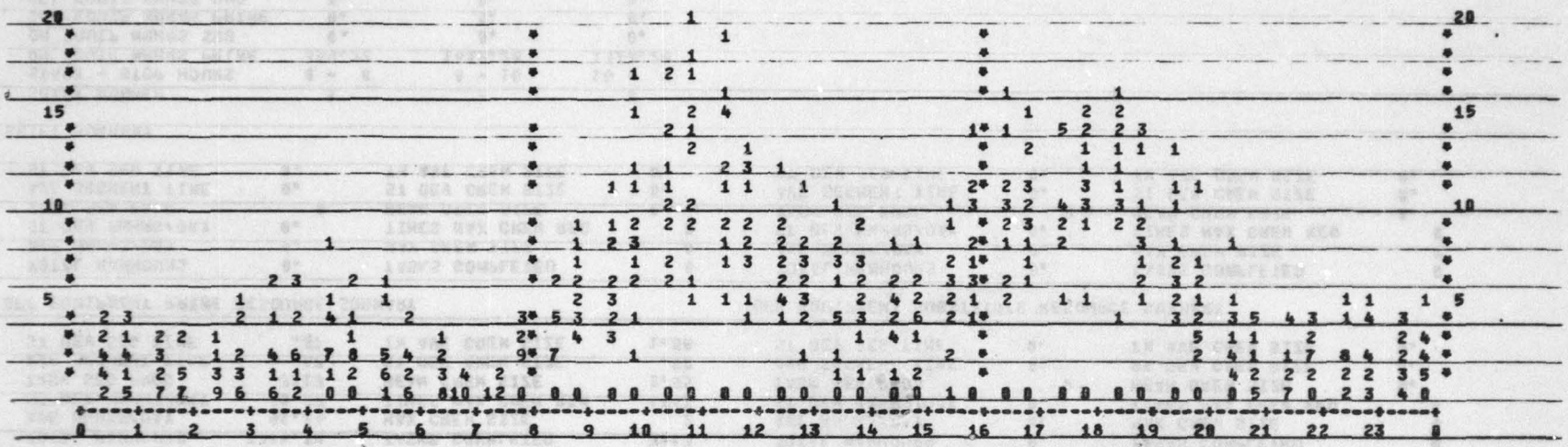
SHIFT SUMMARY

SHIFT NUMBER	1	2	3
START - STOP HOURS	0 - 8	8 - 16	16 - 0
ON EQUIP MNHRS PRIME	359.22	1612.28	1313.28
ON EQUIP MNHRS SUB	0.	0.	0.
OFF EQUIP MNHRS PRIME	0.	0.	0.
OFF EQUIP MNHRS SUB	0.	0.	0.
MAX CREW REQUIRED	2	2	2
LCOM SPACES (25% IND)	1.66	7.46	6.08

50 DAYS OF SIMULATION * 36 DAYS OF DATA * FIRST COMPLETE 5 DAY BLOCK STARTS DAY 14 REPEATS EVERY 7 DAYS

FIGURE A-19. PART 1. S.P. 3.5's MANPOWER MATRIX (CDC)

PRODUCTIVE UTILIZATION MATRIX FOR RESOURCE CONTEC (7)



ON EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	1306.59	TASKS COMPLETED	1236
AVE MNHRS/DAY	93.33	MAX CREW SIZE	2
ST DEV MNHRS/DAY	9.56	TIMES MAX CREW REQ	681
TASK SEG PROC	1236	MEAN CREW SIZE	1.55
AVE SEGMENT TIME	.67	ST DEV CREW SIZE	.50
ST DEV SEG TIME	.38	TM AVE CREW SIZE	1.58

ON EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TM AVE CREW SIZE	0.

OFF EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TM AVE CREW SIZE	0.

OFF EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TM AVE CREW SIZE	0.

SHIFT SUMMARY

SHIFT NUMBER	1	2	3
START - STOP HOURS	0 - 8	8 - 16	16 - 0
ON EQUIP MNHRS PRIME	131.13	646.22	529.25
ON EQUIP MNHRS SUB	0.	0.	0.
OFF EQUIP MNHRS PRIME	0.	0.	0.
OFF EQUIP MNHRS SUB	0.	0.	0.
MAX CREW REQUIRED	2	2	2
LCOM SPACES (25% IND)	1.56	7.69	6.30

50 DAYS OF SIMULATION * 14 DAYS OF DATA * FIRST COMPLETE 2 DAY BLOCK STARTS DAY 12 REPEATS EVERY 7 DAYS

FIGURE A-19. PART 2. S.P. 3.5's MANPOWER MATRIX (CDC)

LGOMII STANDARD VERSION CDC RELEASE 3.5

SPEC IN=1

SYMBOL	MEANINGS		
B	OFF-EQUIPMENT ACTIVITIES	U	UNSCHEDULED MAINTENANCE
C	CONDEMNED	V	SERVICE TASK
D	DEPOT ACTIONS	*	ILLEGAL
F	ACTUAL FLIGHT	+	ILLEGAL
L	IMPOSED DELAYS	-	ILLEGAL
S	SCHEDULED MAINTENANCE		

158265

.3000	140470	81	.3217	2
.3217	140534	85	.3686	2
.3686	140591	2	.3834	3
.4167	140249	3	.4583	1
.4583	140743	5	.4583	5
.4583	139947	94	.4583	5
.4583	140224	4	.4654	3
.4654	140578	6	.4976	3
.4976	140470	47	.5053	2
.4976	140434	25	.5192	2
.5053	140180	48	.5259	2
.5192	140072	26	.5373	2
.5259	140470	50	.5441	2
.5441	139927	51	.5951	2
[illegible]	140131	52	.6000	2
[illegible]	139983	53	.6000	2

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*A/C NO. 158265 DISPLAY ON DAY 0

```
3         4         5         6         7         8         9         0         1         2         3
B12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
UUU
  UUUUU
     SSS
        FFFFF
            V
            V
            SS
             SSSS
                UU
                UUU
                 UUU
                  UUU
                   UUU
                     UUUUUU
                          UU
                          U
```

TASK NUC	STOP TIME	NO. PREM
UL.RCK	.32	0
UL.POD	.37	0
PRELCH	.38	0
SORTIE	.46	0
DCRMNT	.46	0
DECAN	.46	0
FUEL	.47	0
POSELT	.50	0
CMDISP	.51	0
TSHOOT	.52	0
CMTSHT	.53	0
MNREP1	.54	0
RENVC1	.54	0
BCHKC1	.60	0
TRANC1	.60	0
REPLC1	.60	0

FIGURE A-20. PART 1. S.P. 3.5's SAMPLE A/C DISPLAY (CDC)

```
140801
      16.8958   139468      1 16.9375      3
      16.9375   193544      2 16.9511      3
      17.0000   195268      3 17.1531      1
      17.1531   139855      5 17.1531      5
      17.1531   136614      4 17.1602      3
      17.1602   195268      6 17.2038      3
      17.2038   190553     25 17.2296      2
      17.2296   139150     26 17.2476      2
```

*A/C NO. 140801 DISPLAY ON DAY 16

```
8         9         0         1         2         3         4         5         6         7         8
01234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
     SSSSS
       SSS
                FFFFFFFFFFFFFFFF
                               V
                              SS
                             SSSSS
                               UUU
                                 UUU
```

TASK WUC	STOP TIME	NO. PREM
PREFLT	16.94	0
PRELCH	16.95	0
SORTIE	17.15	0
DCRMNT	17.15	0
FUEL	17.16	0
POSFLT	17.20	0
TSHOOT	17.23	0
MNREP1	17.25	0

FIGURE A-20 . PART 2. S.P. 3.5's SAMPLE A/C DISPLAY (CDC)

MISSION SUCCESS STATISTICS — RUN NUMBER SP3.5U — PAGE 77

LEVEL 3 REPORT — FROM 10.0 TO 60.0

MSN/ACT NAME	TIME SCHED	SIZE MAX	SIZE MIN	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	PCT	TAKEOFF LATE	PCT
PREFLT	300	14	0	10	10	1.000	140	140	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	15	0	8	8	1.000	120	120	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	16	0	8	8	1.000	128	128	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	17	0	9	9	1.000	153	153	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	18	0	2	2	1.000	36	36	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	19	0	13	13	1.000	247	247	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	600	2	2	50	50	1.000	100	100	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRO3	700	1	1	50	50	1.000	50	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	800	4	3	50	50	1.000	200	200	1.000	0	0	0	0	1	0	0	0	0.	0	0.
INTRO1	830	2	2	50	50	1.000	100	100	1.000	16	4	0	0	0	0	30	16	.160	6	.060
RECON	1000	2	2	50	50	1.000	100	100	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY1	1030	1	1	50	50	1.000	50	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRO1	1230	2	2	50	50	1.000	100	100	1.000	12	13	0	0	0	0	25	30	.300	8	.080
CLSPT1	1320	3	2	50	50	1.000	150	140	.933	0	10	0	0	0	0	0	12	.080	0	0.
INTRO2	1400	2	2	50	48	.960	100	96	.960	6	19	2	0	5	0	27	64	.640	16	.167
RECON	1500	2	2	50	49	.980	100	98	.980	1	23	1	0	0	0	27	87	.870	18	.184
RECON	1600	1	1	50	50	1.000	50	50	1.000	0	0	0	0	0	1	0	16	.320	6	.120
RECON	1800	1	1	50	50	1.000	50	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2000	1	1	50	50	1.000	50	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2200	1	1	50	50	1.000	50	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY2	2400	2	2	50	50	1.000	100	100	1.000	0	0	0	0	0	0	0	0	0.	0	0.

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MISSION SUCCESS STATISTICS — RUN NUMBER SP3.5U — PAGE 78

LEVEL 3 SUMMARY REPORT — FROM 10.0 TO 60.0

MISSION IDENT	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	DAYLIGHT SORTIES ATTD	DAYLIGHT SORTIES PCT	DAYLIGHT SORTIES FLOWN	DAYLIGHT SORTIES PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	PCT	TAKEOFF LATE	PCT
FERRY2	50	50	1.000	100	100	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	50	50	1.000	824	824	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.
RECON	350	349	.997	500	498	.996	350	.700	348	.699	1	23	1	0	0	1	27	103	.206	24	.048
INTRO3	50	50	1.000	50	50	1.000	50	1.000	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	50	50	1.000	200	200	1.000	200	1.000	200	1.000	0	0	0	0	1	0	0	0	0.	0	0.
INTRO1	100	100	1.000	200	200	1.000	200	1.000	200	1.000	28	17	0	0	0	0	55	46	.230	14	.070
FERRY1	50	50	1.000	50	50	1.000	50	1.000	50	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT1	50	50	1.000	150	140	.933	150	1.000	140	1.000	0	10	0	0	0	0	0	12	.080	0	0.
INTRO2	50	48	.960	100	96	.960	100	1.000	96	1.000	6	19	2	0	5	0	27	64	.640	16	.167

FIGURE A-21. S.P. 3.5's MISSION POST PROCESSOR OUTPUT (CDC)

MODEL SUPPORT EQUIPMENTS DEMANDS

RESOURCE ID 10 ON -EQUIPMENT

```
3 +                                                
```

ACTUAL SUPPORT EQUIPMENT DEMANDS

RESOURCE ID 10 ON -EQUIPMENT

```
3 +                                                
```

VI. STANDARD SYSTEM RELEASE (IBM)

Version 3.5, dated 12 October 1979 is the systems release herein described.

A. System Release Tape

The nine track tape produced for the LCOM II Systems Release contains all the necessary program and data files for system implementation and initial check out with sample Problem #3.5. In the write-up and listings that follow, all names shown for data sets on disk or tape are recommended names for consistency of description. Data Set sizes given are the approximate sizes required for the initial unloading of the tape files.

B. Release Tape File Description

File #	Description	Data Set Name	Data Set Size (Tracks)
1	Input Module BIN LKED	INPTSTND	21
2	Simulation Module BIN LKED	MAINSTND	35
3	Decoder P.P. BIN LKED	DCDRSTND	8
4	Manpower Matrix P.P. BIN LKED	MTRXSTND	12
5	Display P.P. BIN LKED	DPLYSTND	5
6	Parts P.P. BIN LKED	PRTSSTND	5
7	Graph P.P. BIN LKED	GRPHSTND	6
8	Mission P.P. BIN LKED	MISNSTND	10
9	Support Equip P.P. BIN LKED	SEPPSTND	5
10	Sample Problem Forms	SAMPPROB	1
11	Change Card File (Unconstrained)	CHNGUNC	1
12	Change Card File (Constrained)	CHNGCON	1

C. Additional Disk/Tape Files Needed to Make Full System Test.

Data Set Name	Description	Type Data
EXOG60D	60 Day Exogenous File	BCD
INITSP	Sample Problem Initialization File	BIN
GRPHOUT	Graph Data Produced by SIMRUN/DECODER	BIN
PRTSDICT	Parts Dictionary Produced by SIMRUN/DECODER	BIN
MTRXDICT	MTRX Dictionary Produced by SIMRUN/DECODER	BIN
DSPLOUT	Display Data Produced by SIMRUN/DECODER	BIN
USIMOUT	Integrated SIMRUN Unconstrained P.P. output	BIN
CSIMOUT	Integrated SIMRUN Constrained P.P. output	BIN
ISIMOUT	Initialization Data for SIMRUN	BCD
PRTSBCD	Output of DECODER forPARTS SORT	BCD
PRTSOUT	PRTS.BCD File Sorted	BCD
MTRXBCD	Output of DECODER for MTRX SORT	BCD
MTRXOUT	MTRX.BCD File Sorted	BCD
RFSDATA	Realized Flying Schedule output from DECODER	BCD
SEQDATA	Support Equipment Date output from DECODER	BCD
SEPPBCD	Output of DECODER for SEPP SORT	BCD

D. Run Control Cards.

1. Job control language (Control Cards) necessary to copy the LCOM II system release tape to Disk Data Sets and conduct test runs are described below and are included in table A-3. Figure A-20 contains charts showing the interfaces between runs 3 thru 9. Data set names within these listings and charts make reference to the same data set names specified in para B and C above. The data set name of all the LCOM programs' binary link-edited object files is XXXXXXX.LCOMCOMP.

Run #	Description
1	Utility Program to copy 11 LCOM II System Disk Files to the Systems Release Tape.
2	Utility Program to copy 11 tape files to disk.
3	Input Module Run of provided Sample Problem.
4	Main SIMRUN (Unconstrained) using Data from Run 3.
5	Decoder Run using Data from Run 4.
6	Parts Post processor run using Data from Run 5.
7	Graph Post Processor Run using Data from Run 5.
8	Manpower Matrix Post Processor Run using Data from Run 5.
9	Display Post Processor Run using Data from Run 5.
10	Mission Post Processor Run using Data from Run 5.
11	Support Equipment Post Processor Run using Data from Run 5.

2. Note: The Input Module Run, Run #3, is processing this test case's Initialization Process and Sortie Generation Process together. However, with large data bases these processes are normally run separate using appropriate null files. Substitutions to satisfy your own computer system's requirements may also be required.

E. Description of Test Run Results (For checkout purposes)

1. Run #1 - System copy to tape - Performed by AFMSMET only.

2. Run #2 - UTILITY (Tape to Disk) - Users initial run.

3. Run #3 - Input Module.

a. Legal warning and information messages will be found throughout the listing. The message # and quantity found are as follows (#/Qty); 41/1, 144/7, 140/1, 20/1, 67/1, 16/1, 17/1, 24/1 (NONE), 36/1 (NONE), 11/1 (NONE), 96/1 (7 entries), 97/1 (NONE), 79/1 (NONE), 80/1 (NONE), 4/1 (1 entry), 146/1 (NONE), 147/1 (NONE), 117/1 (NONE), 31/1 (1 entry), and 53/1. Also, with SPEC card option INFO=3, the node range report (MSG 17) will be printed in full.

b. Total sorties generated, by mission type (report):

MSNAM	NO MSN	NO SORT	FLY HRS
PREFLT	60	60	0.0
RECON	420	600	479.987
INTRD1	120	240	363.313
CLSPT1	60	180	137.918
CLSPT2	60	240	346.119
INTRD2	60	120	183.857
INTRD3	60	60	59.999
FERRY1	60	60	119.923
FERRY2	60	120	232.238

c. Input Data Summary (report):

Qty	Descriptor
23	Resources
96	Task Names
130	Node Names
163	Control Table Entries
11	Failure Clocks
9	Mission Entry Points (IETB)
3	Resources Entering Network (NACO)
6	Total # of Configurations Defined (All A/C) (NCRS)
9	Search Patterns (NSRPT)
13	Next Higher Failures (NNHF)
70	Task Resource Requirements (TRR)
9	Unique Groups of Clock Decrements (NOCL)
1	Unique Pieces of Internal Equipment (EQUIP)
2	Internal Equipment Groups (ILIST)
2	Triggering Events (NTEVT.DV)
9	Operations Headings on Form 10
3	Aircraft Headings on Form 10
10	Personnel Headings on Form 10
10	Part Headings on Form 10
2	AGE Headings on Form 10

d. To insure full preparation of an initialization file, two messages must follow the printing of the dictionaries. These messages are as follows and may be followed by a printout of the entire initialization file data and an additional message "LEGITIMATE END MARKER READ".

. MAIN MODEL INIT FILE IS TO BE PRODUCED.
. LEGITIMATE END MARKER WRITTEN

4. Run #4 - Main Module Run (Unconstrained):

This new sample Problem #3 does not provide a fully unconstrained run. The applicable camera technicians are slightly constrained and the pre-sortie time line for internal reconfigurations may require adjustment to permit an unconstrained 100% flying support. It is expected that future versions of this sample problem will again produce truly unconstrained run results.

a. Unconstrained Run

(1) From the Level II day 10-60 Performance Summary Report, the following selected statistics/total values are given:

#	Statistics	Value
3	Percent accomplished	100.00
8	Percent accomplished	99.78
T4	No. of Attritions	2.00
T5	No. of RAM Repairs	5.0
23	Avg No. of Sorties/ A/C /Day	1.32
24	Flying Hours	1602.60
33	No. of men demanded	32086.00
40	Simulated MH Fer Flying Hr	11.72
44	No. of reparables generated	6558.00
57	No. of units demanded	6755.00
75	No. of units demanded	1070.00

(2) From the end of run Stop (or Memory Saved) Report at time 100.01; total jobs started = 57146, jobs completed = 57146, and jobs preempted = 0.

b. Constrained Run

(1) From the Level II day 10-60 Performance Summary Report, the following selected statistics/total values are given:

#	Statistics	Value
3	Percent accomplished	95.2
8	Percent accomplished	93.48
T4	No. of Attrition	2.00
T5	No. of RAM repairs	3.00
23	Avg No. of Sorties/ A/C /Day	1.22
24	Flying Hours	1506.13
33	No. of men demanded	30935.00
40	Simulated MH Per Flying Hour	12.10
44	No. of reparables generated	6468.00
57	No. of units demanded	6519.00
62	No. of cannibalizations	8.00
75	No. of units demanded	1037.00

(2) From the end of run Stop (or Memory Saved) Report at time 100.01; total jobs started = 55240, jobs completed = 55192, and jobs preempted = 48.

5. Run #5 Decoder Run (Unconstrained): A two page report is printed as shown in Figure A-20. The number of records written to the GRAPH file printed because the DECODER P.P. was executed only for the purpose of executing the GRAPH P.P. later. The number of records written to the other post processors is as follows:

```
  428 RECORDS WERE WRITTEN TO THE DISPLAY FILE.
   10 RECORDS WERE WRITTEN  PARTS BINARY
11800 RECORDS WERE WRITTEN  PARTS BCD
    1 RECORDS WERE WRITTEN  MATRIX BINARY
92767 RECORDS WERE WRITTEN  MATRIX BCD
 5741 RECORDS WERE WRITTEN  RFS
 1245 RECORDS WERE WRITTEN  SUPPORT EQUIPMENT
    0 RECORDS WERE WRITTEN  TASK POST PROCESSOR
```

6. Run #6 Parts Sort and Parts Post Processor (Unconstrained)

a. Parts Sort Records Input = 11800, Records output = 11800.

b. See Figure A-22 for run results.

7. Run #7 GRAPH POST Processor. (Unconstrained)

a. See Figure A-23 for Histogram of post sortie A/C turnaround times.

b. See Figure A-24 for graph of Stat 22 (Avg AC Post-Sortie Time (Hrs).

8. Run #8 Marix Sort and Matrix Post Processor (Unconstrained).

a. MTRX SORT - Records Input = 92767. Records Output = 92767.

b. See Figure A-25 for one set of matrices (two parts) printed in the run.

9. Run #9 Display Post Processor (Uncon). See Figure A-26 for the first full display of each aircraft (Day 0 and Day 16).

10. Run #10 Mission Post Processor (Uncon). See Figure A-27 for the final Level 2 Mission Success Statistics Summary Report.

11. Run #11 Support Equipment Post Processor (Uncon.). See Figure A-28 for the model and actual on-equipment demands for the resource called truck in the sample problem.

F. SIMSCRIPT II Systems Release

All installations using LCOM II are responsible for obtaining their own SIMSCRIPT II.5 compiler maintenance. AFMSMET has taken extreme care in attempting to provide an LCOM II model that would run on the Final Air Force release #12. However, latent errors found in release #12 make a subsequent release under a GSA maintenance contract a preferable compiler for use with the LCOM II system. AFMSMET can provide Binary Link-edited object programs to those Air Force installations where there is no compiler maintenance contract. However, the user is responsible for ensuring that the software at his computer installation is compatible with the standard software release in use at Wright-Patterson Air Force Base, Ohio. Any computer system software differences that prevent the SIMSCRIPT II execution library from functioning will preclude AFMSMET's support to such installations.

G. System Improvements - Included in IV.H.

H. Known Errors - Included in IV.J.

Table A-3 IBM Release 3.5 Runs - JCL

```
//RUN2  JOB  (XXXX,XXX,,2),'REISS',MSGLEVEL=1,
//      REGION =100K,TIME=2,CLASS=C
//*  UTILITY JCL TO COPY 11 TAPE FILES TO DISK
//LOAD  EXEC  PGM=IEBCOPY
//SYSPRINT  DD  SYSOUT=A
//FROM  DD  DSN=LCOMREL,UNIT=TAPE,LABEL=(,NL),
//      VOL=SER=XXXXXX,DISP=OLD
//TO  DD  DSN=LCOMPGMS,UNIT=3330,VOL=SER=XXXXXX,
//      DISP=(NEW,KEEP),DCB=(DEN=X),SPACE=(CYL,(5,2),RLSE)
//SYSUT3  DD  DSN=TEMP,UNIT=3330,DISP=(NEW,DELETE),
//      VOL=SER=XXXXXX,SPACE=(TRK,(2))
//SYSIN  DD *
      COPY OUTDD=TO,INDD=FROM
/*
//
```

- - - -

Table A-3 cont'd.

```
//RUN4U  JOB  (XXXX,XXX,,6),'REISS',MSGLEVEL=1,
//       REGION=450K,TIME=10,CLASS=Z
//*  MAIN SIMRUN (UNCON) USING RUN3 DATA
//MAIN  EXEC  PGM=MAINSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A
//SIMUØ5  DD *
SPEC CHNG=1  INIT=7  EXOG=9  POST=3  DATA=2
/*
//SIMUØ1  DD  DSN=CHNGUNC,DISP=(OLD,KEEP)
//SIMUØ2  DD  DUMMY,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMUØ3  DD  DSN=USIMOUT,DISP=(NEW,KEEP),UNIT=TAPE,VOL=SER=XXXXXX,
//       DCB=(RECFM=VB,LRECL=800,BLKSIZE=804),LABEL=(1,NL)
//SIMUØ7  DD  DSN=INITSP,DISP=(OLD,KEEP)
//SIMUØ9  DD  DSN=EXOG60D,DISP=OLD,UNIT=TAPE,VOL=SER=XXXXXX,
//       DCB=(RECFM=FB,LRECL=800,BLKSIZE=800),LABEL=(1,NL)
/*
//
```

** EXCHANGE CARDS TO MAKE ABOVE RUN CONSTRAINED **

```
//RUN4C  JOB  (XXXX,XXX,,6),'REISS',MSGLEVEL=1,
//       REGION=450K,TIME=20,CLASS=Z
//SIMUØ1  DD  DSN=CHNGCON,DISP=(OLD,KEEP)
//SIMUØ3  DD  DSN=CSIMOUT,DISP=(NEW,KEEP),UNIT=TAPE,
//            VOL=SER=XXXXXX
```

Table A-3 cont'd.

```
//RUN5  JOB  (XXXX,XXX,,3),'REISS',MSGLEVEL=1,
//      REGION=100K,TIME=5,CLASS=Z
//*  DECODER RUN USING RUN 4 DATA
//DCDR  EXEC  PRM=DCDRSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMUØ5  DD *
SPEC GRPD=9  PRTS=1Ø  PBCD=14  MTRX=13  DPLY=12  SEQ=8  IN=1
RFS=11  MBCD=15  DBUG=Ø
/*
//SIMUØ1  DD  DISP=(OLD,KEEP),DSN=USIMOUT,UNIT=TAPE,
//            LABEL=(1,NL),VOL=SER=XXXXXX,
//            DCB=(RECFM=VB,LRECL=800,BLKSIZE=804)
//SIMUØ8  DD  DSN=SEQDATA,DISP=(NEW,KEEP),UNIT=TAPE,
//            LABEL=(1,NL),VOL=SER=XXXXXX,
//            DCB=(RECFM=FB,LRECL=56,BLKSIZE=560)
//SIMUØ9  DD  DSN=GRPHOUT,UNIT=TAPE,DISP=(NEW,KEEP),
//            LABEL=(1,NL),VOL=SER=XXXXXX,
//            DCB=(RECFM=VB,LRECL=800,BLKSIZE=804)
//SIMU1Ø  DD  DSN=PRTSDICT,DISP=(NEW,CATLG,DELETE),UNIT=3330,
//            VOL=SER=XXXXXX,SPACE=(TRK,(2,1),RLSE),
//            DCB=(RECFM=VB,LRECL=800,BLKSIZE=804)
//SIMU11  DD  DSN=RFSDATA,UNIT=TAPE,DISP=(NEW,KEEP),
//            LABEL=(1,NL),VOL=SER=XXXXXX,
//            DCB=(RECFM=VB,LRECL=64,BLKSIZE=964)
//SIMU12  DD  DSN=DPLYOUT,DISP=(NEW,CATLG,DELETE),UNIT=3330,
//            VOL=SER=XXXXXX,SPACE=(TRK,(2,1),RLSE),
//            DCB=(RECFM=VB,LRECL=800,BLKSIZE=804)
//SIMU13  DD  DSN=MTRXDICT,DISP=(NEW,CATLG,DELETE),UNIT=3330,
//            VOL=SER=XXXXXX,SPACE=(TRK,(2,1),RLSE),
//            DCB=(RECFM=VB,LRECL=800,BLKSIZE=804)
//SIMU14  DD  DSN=PRTSBCD,DISP=(NEW,KEEP),UNIT=TAPE,
//            LABEL=(1,NL),VOL=SER=XXXXXX,
//            DCB=(RECFM=FB,LRECL=48,BLKSIZE=960)
//SIMU15  DD  DSN=MTRXBCD,DISP=(NEW,KEEP),UNIT=TAPE,
//            LABEL=(1,NL),VOL=SER=XXXXXX,
//            DCB=(RECFM=FB,LRECL=32,BLKSIZE=800)
/*
//
```

Table A-3 cont'd.

```
//RUN6  JOB  (XXXX,XXX,,1),'REISS',MSGLEVEL=1,
//      REGION=260K,TIME=2,CLASS=C
//*  PARTS POST PROCESSOR USING RUN 5 DATA
//SORT  EXEC  PGM=SORT,PARM='MSG=AP'
//SYSOUT  DD  SYSOUT=A
//SORTLIB  DD  DSN=SYS1.SORTLIB,DISP=SHR
//SORTWKØ1  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ2  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ3  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ4  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTIN  DD  DSN=PRTSBCD,DISP=(OLD,DELETE),UNIT=TAPE,
//        LABEL=(1,NL),VOL=SER=XXXXXX,
//        DCB=(RECFM=FB,LRECL=48,BLKSIZE=960)
//SORTOUT  DD  DSN=PRTSOUT,DISP=(,PASS),UNIT=SYSDA,
//         SPACE=(TRK,(50,20),RLSE),
//         DCB=(RECFM=FB,LRECL=48,BLKSIZE=960)
//SYSIN  DD *
COL
 2
 SORT FIELDS=(1,6,CH,A,7,10,FL,A),SIZE=E24000
/*
//PRTS  EXEC  PGM=PRTSSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMUØ5  DD *
SPEC IN=14  DICT=10  DAYS=60
//SIMU10  DD  DSN=PRTSDICT,DISP=(OLD,DELETE)
//SIMU14  DD  DSN=PRTSOUT,DISP=(OLD,DELETE)
/*
//
```

```
//RUN7  JOB  (XXXX,XXX,,2),'REISS',MSGLEVEL=1,
//      REGION=100K,TIME=2,CLASS=C
//*  GRAPH POST PROCESSOR USING RUN 5 DATA
//GRPH  EXEC  PGM=GRPHSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMUØ9  DD  DSN=GRPHOUT,UNIT=TAPE,DISP=(OLD,DELETE),
//            LABEL=(1,NL),VOL=SER=XXXXXX
//SIMUØ5  DD *
SPEC DAYS=10  STAT=6  STRT=1  STOP=60  IN=9
3 6 22 32 39 51 *
/*
//
```

Table A-3 cont'd.

```
//RUN8  JOB  (XXXX,XXX,,5),'REISS',MSGLEVEL=1,
//      REGION=380K,TIME=5,CLASS=Z
//*  MATRIX POST PROCESSOR USING RUN 5 DATA
//SORT  EXEC  PGM=SORT,PARM='MSG=AP'
//SYSOUT  DD  SYSOUT=A
//SORTLIB  DD  DSN=SYS1.SORTLIB,DISP=SHR
//SORTWKØ1  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ2  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ3  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ4  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ5  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ6  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTIN  DD  DSN=MTRXBCD,DISP=(OLD,DELETE),UNIT=TAPE,
//            VOL=SER=XXXXXXX,LABEL=(1,NL),
//            DCB=(LRECL=32,RECFM=FB,BLKSIZE=800)
//SORTOUT  DD  DSN=MTRXOUT,DISP=(,PASS),UNIT=SYSDA,
//             SPACE=(CYL,(5,2))
//             DCB=RECFM=FB,LRECL=32,BLKSIZE=800)
//SYSIN  DD *
col
 2
 SORT FIELDS=(2,4,CH,A,1,1,CH,A,6,10,CH,A),SIZE=E80000
/*
//MTRX  EXEC  PGM=MTRXSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMUØ5  DD *
SPEC IN=2  DICT=13  NUM=9  STRT=Ø  STOP=6Ø  NBLK=2  BLK1=5
BLK2=2 *
CREWCH1253000816
CREWCH2253000816
OMPERS1253000816
OMPERS2253000816
FLTENG1253000816
FLTENG2253000816
HYDTEC1253000816
HYDTEC2253000816
HYDSPL1253000816
HYDSPL2253000816
COMTEC1253000816
COMTEC2253000816
COMSPL1253000816
COMSPL2253000816
MUNSPL1253051321
MUNSPL2253051422
CAMTEC1253051422
CAMTEC2253051422
/*
//SIMUØ2  DD  DSN=MTRXOUT,DISP=(OLD,DELETE)
//SIMU13  DD  DSN=MTRXDICT,DISP=(OLD,KEEP)
/*
//
```

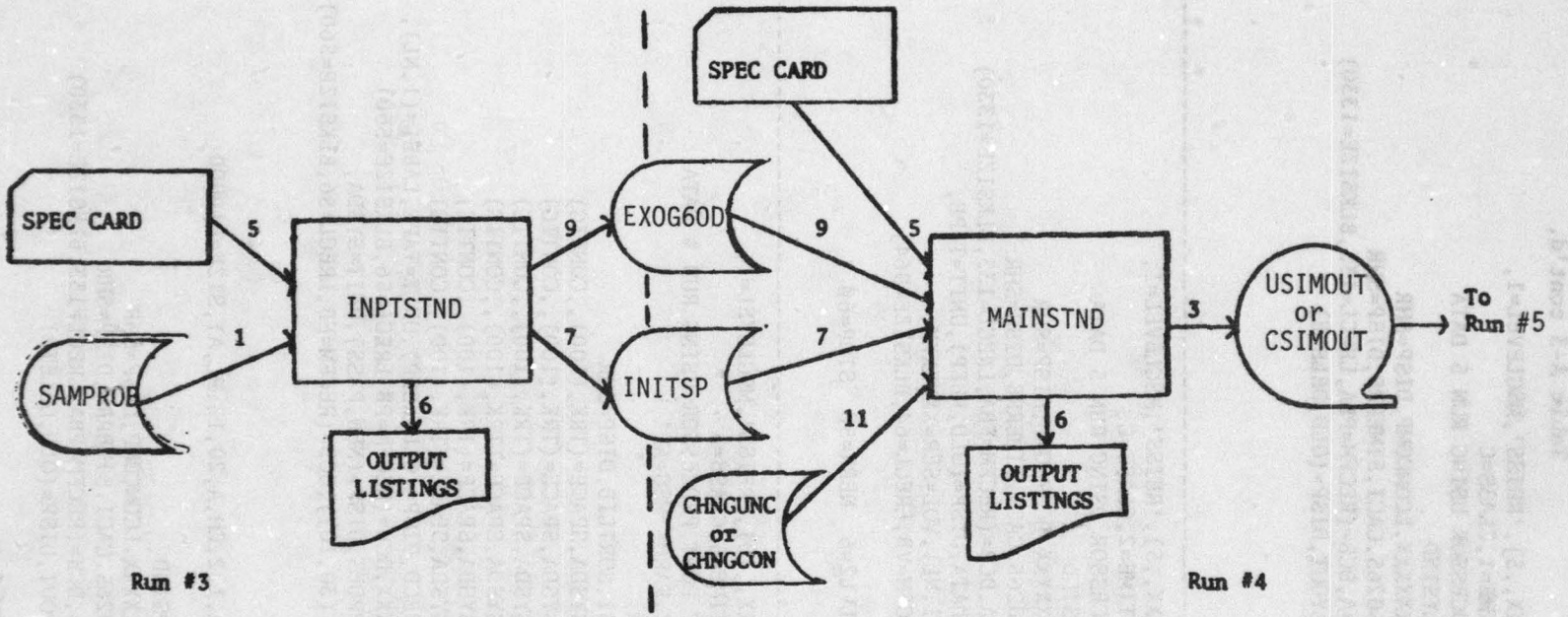
Table A-3 cont'd.

```
//RUN9  JOB  (XXXX,XXX,,5),'REISS',MSGLEVEL=1,
//       REGION=75K,TIME=1,CLASS=C
//*  DISPLAY POST PROCESSOR USING RUN 5 DATA
//DPLY  EXEC  PGM=DPLYSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMU12  DD  DSN=DPLYOUT,DISP=(OLD,DELETE)
//SIMUØ5  DD *
SPEC IN=12  DEBUG=3
/*
//
```

```
//RUN1Ø  JOB  (XXXX,XXX,,5),'REISS',MSGLEVEL=1,
//       REGION=100K,TIME=2,CLASS=C
//*  MISSION POST PROCESSOR USING RUN 5 DATA
//MSN  EXEC  PGM=MISNSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMU11  DD  DSN=RFSDATA,DISP=(OLD,KEEP),UNIT=TAPE,
//            LABEL=(1,NL),VOL=SER=XXXXXXX,
//            DCB=(RECFM=VB,LRECL=64,BLKSIZE=964)
//SIMUØ5  DD *
SPEC IN=11  LVL1=1Ø  LVL2=6  NERR=5Ø  STOP=6Ø *
/*
//
```

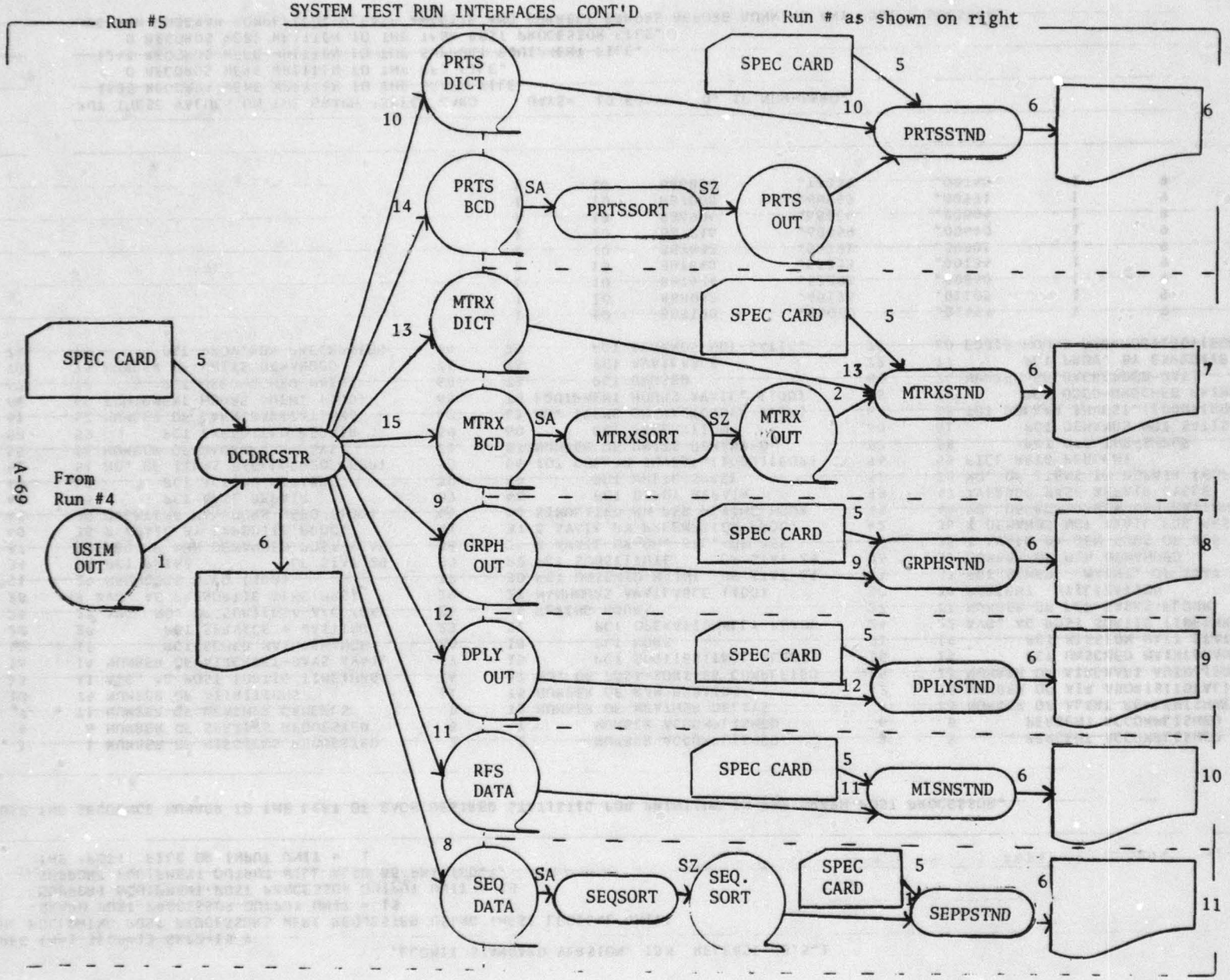
```
//RUN11  JOB  (XXXX,XXX,,10),'REISS',MSGLEVEL=1,
//       REGION=200K,TIME=5,CLASS=A
//*  SUPPORT EQUIPMENT POST PROCESSOR USING RUN % DATA
//SORT  EXEC  PGM=SORT,PARM='MSG=AP'
//SYSOUT  DD  SYSOUT=A
//SORTLIB  DD  DSN=SYS1,SORTLIB,DISP=SHR
//SORTWKØ1  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ2  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ3  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ4  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ5  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTWKØ6  DD  UNIT=SYSDA,SPACE=(TRK,(100),,CONTIG)
//SORTIN  DD  DSN=SEPPBCD,DISP=(OLD,KEEP),UNIT=TAPE,LABEL=(1,NL),
//       VOL=SER=XXXXXX,DCB=(RECFM=FB,LRECL=56,BLKSIZE=560)
//SORTOUT  DD  DSN=SEPPOUT,DISP=(NEW,PASS),UNIT=SYSDA,
//        SPACE=(TRK,(30,10)),DCB=(RECFM=FB,LRECL=56,BLKSIZE=560)
//SYSIN  DD *
col
 2
 SORT FIELDS=(4,6,CH,A,1,2,CH,A,20,11,FL,A),SIZE=E10000
/*
//SEPP  EXEC  PGM=SEPPSTND
//STEPLIB  DD  DSN=XXXXXXX.LCOMCOMP,DISP=SHR
//SIMU17  DD  DSN=A750265.CACI.SIMERR8,DISP=SHR
//SIMUØ6  DD  SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
//SIMUØ1  DD  DSN=SEPPOUT,DISP=(OLD,DELETE)
//SIMUØ5  DD *
SPEC  IN=1  STOP=60 NUM=1 *
10 *
/*
//
```

FIGURE A-24. SYSTEM TEST RUN INTERFACES (IBM)



Note: The numbers shown near the individual files are those used in the system test, and assigned through the SPEC card for that run.

SYSTEM TEST RUN INTERFACES CONT'D



```
                                LCOMII STANDARD VERSION  IBM  RELEASE  3.5.1
$SPEC IN=1 SEQP=13 GRPO=15 *
THE FOLLOWING POST PROCESSORS WERE REQUESTED USING THESE LOGICAL UNITS
     GRAPH POST PROCESSOR OUTPUT UNIT = 15
     SUPPORT EQUIPMENT POST PROCESSOR OUTPUT UNIT = 13
     SUPPORT EQUIPMENT OUTPUT WILL ALSO BE PRINTED.
     THE 'POST' FILE OR INPUT UNIT =  1

USE THE SEQUENCE NUMBER TO THE LEFT OF EACH DESIRED STATISTIC FOR PRINTING IN THE GRAPH POST PROCESSOR.

  1     1 NUMBER OF MISSIONS REQUESTED          2     2       NUMBER ACCOMPLISHED          3     3       PERCENT ACCOMPLISHED
  4     6 NUMBER OF SORTIES REQUESTED           5     7       NUMBER ACCOMPLISHED          6     8       PERCENT ACCOMPLISHED
  7    T1 NUMBER OF WEATHER CANCELS             8    T2 NUMBER OF WEATHER DELAYS           9    T3 NUMBER OF ALERT REPLENISHMENT
 10    T4 NUMBER OF ATTRITIONS                 11    T5 NUMBER OF RAM REPAIRS             12    T6 NUMBER OF AIR ABORTS(TOTAL)
 13    A1 AVG. AC POST SORTIE TIME(HRS)        14    A2 NO. OF POST-SORTIES COMPLETED     15    13 NUMBER OF AIRCRAFT AUTH.(EOP)
 16    14 NUMBER OF AIRCRAFT-DAYS AVAIL        17    15       PCT SORTIES(INCL ALERT)     18    16       PCT UNSCHED MAINTENANCE
 19    17       PCT SCHED MAINTENANCE          20    18       PCT NORS                    21    19       PCT MISSION WAIT STATUS
 22    20       PCT SERVICE + WAITING          23    21       PCT OPERATIONALLY READY     24    22 AVG. AC POST SORTIE TIME(HRS)
 25    23 AVG. NO. OF SORTIES/ A/C /DAY        26    24 FLYING HOURS                      27    T7 NUMBER OF FCF TASKS FLOWN
 28   T8 AVG. AC PRESORTIE TIME(HRS)           29    27 MANHOURS AVAILABLE (100)          30    28 PERCENT  UTILIZATION
 31    29 MANHOURS USED (100)                  32    30 PCT UNSCHED MAINT. OF STAT 29     33    31 PCT SCHED  MAINT. OF STAT 29
 34    P1 PCT PRIME          OF STAT 29        35    P2 PCT SUBSTITUTE     OF STAT 29     36    33 NUMBER OF MEN DEMANDED
 37    P3 NBR OF MEN DEMANDED POST SCAN        38    34 % AVAIL BY OH. BAL. OF RES        39    35 % AVAIL BY GEN SUBS OF RES
 40    36 % AVAIL BY EXPEDITE PROC.            41    37 % AVAIL BY PREEMPTION PROC.       42    38 % DEMANDS NOT AVAIL FOR RES
 43    39 OVERTIME MANHOURS USED (100)         44    40 SIMULATED MH PER FLYING HOUR      45    44 NO. OF REPARABLE GENERATIONS
 46    45       PCT BASE REPAIR                47    46       PCT DEPOT REPAIR            48    47 AVERAGE BASE REPAIR CYCLE
 49    48       PCT ACTIVE REPAIR              50    49       PCT WHITE SPACE             51    50 NO. OF ITEMS IN REPAIR (EOP)
 52    51 NO. OF ITEMS BACKLOGGED (EOP)        53    54 TOT DOLLAR INVEST.(1000)(EOP)     54    55 FILL RATE PERCENT
 55    56 NUMBER OF BACKORDER-DAYS             56    57 NUMBER OF UNITS DEMANDED          57    58       PCT OFF-THE-SHELF
 58    59       PCT EXPEDITED REPAIR           59    60       PCT PREEMPTION              60    61       PCT DEMANDS NOT SATIS.
 61    62 NUMBER OF CANNIBALIZATIONS           62    63 NO. ITEMS ON BACKORDER (EOP)      63    68 TOT DOLLAR INVEST.(1000)(EOP)
 64    69 EQUIPMENT HOURS AUTH. (100)          65    70 EQUIPMENT HOURS AVAIL. (100)      66    71       PCT USED-UNSCHED MAINT
 67    72       PCT USED-SCHED MAINT           68    73       PCT UNUSED                  69    74 NUMBER OF BACKORDER-DAYS
 70    75 NUMBER OF UNITS DEMANDED             71    76       PCT AVAILABLE               72    77       PCT PROV. BY EXPEDITE
 73    78       PCT PROV. BY PREEMPTION        74    79       PCT DEMANDS NOT SATIS.      75    80 EQUIP HOURS BACKLOG(100)(EOP)

                                                1     10     888120     .43089     .01457     1     9
                                                1     10     888032     .45176     .01105     1     9
                                                1     10     887424     .52202     .00840     1     9
                                                1     10     887840     .55233     .00134     1     9
                                                1     10     887632     .55291     .00901     1     9
                                                1     10     887216     .60459     .00640     1     9
                                                1     10     886904     .68684     .00504     1     9
                                                1     10     887008     .68985     .00531     1     9
                                                1     10     886800     .73034     .00745     1     9

     PUT THESE VALUES ON THE GRAPH 'SPEC' CARD     DAYS=  10 FDAY=   0, IF NON-ZERO.
     1625 RECORDS WERE WRITTEN TO THE GRAPH FILE.
        0 RECORDS WERE WRITTEN TO THE RES FILE.
     1245 RECORDS WERE WRITTEN TO THE SUPPORT EQUIPMENT FILE.
        0 RECORDS WERE WRITTEN TO THE TASK POST PROCESSOR FILE.
     DECODER PROGRAM COMPLETED. PLEASE ANALYZE AND CORRECT ERRORS BEFORE RUNNING ANY POST PROCESSOR.
```

FIGURE A-25. S.P. 3.5's Decoder Output (IBM)

PART WUC	STANDARD STATISTICS UNIT COST	NO. DEMANDS	# DAYS STOCK OUT	BASE STATISTICS NO. REPAIRED	MAX CYCLE TIME	DEPOT STATISTICS NO. REPAIRED	MAX CYCLE TIME
	AUTHORIZED LEVEL	AVG DAILY DEMAND	# DAYS BACKORDER	NO. CONDEMNED	AVG CYCLE TIME	NO. CONDEMNED	AVG CYCLE TIME
	AVG QUAN ON HAND	DEMDS NOT SATIS.	BACKORDER RATE	CONDEMNED RATE	STD DEV C-TIME	CONDEMNED RATE	STD DEV C-TIME
	MIN QUAN ON HAND	TIME BETWN DEMDS		AV DECISION TIME		BASE NRTS RATE	
PUMPH1	$ 100.00	19	0.	12	1.860109	7	27.782211
	99	.1900	0.	0	1.102950	0	19.532562
	97.5012	0	0. %	0. %	.546341	0. %	4.545129
	95	3.126819		.010155		36.842 %	
PUMPH2	$ 100.00	79	0.	70	3.038594	9	34.732147
	99	.7900	0.	0	2.083240	0	23.257736
	95.4528	0	0. %	0. %	.511236	0. %	5.645641
	89	.762782		.010440		11.392 %	
RDASSY	$ 1000.00	1153	0.	1153	.110994	0	0.
	99	11.5300	0.	0	.081007	0	0.
	98.1321	0	0. %	0. %	.006848	0. %	0.
	91	.051971		.010410		0. %	
RADC11	$ 500.00	731	0.	529	.106098	202	33.149841
	299	7.3100	0.	0	.072588	0	19.339493
	259.5774	0	0. %	0. %	.010718	0. %	5.875661
	225	.081999		.010450		27.633 %	
RADC12	$ 500.00	775	0.	652	.089178	123	35.532028
	299	7.7500	0.	0	.073099	0	20.678864
	273.1194	0	0. %	0. %	.004649	0. %	5.568565
	241	.077327		.010426		15.871 %	
BMS500	$ 1000.00	3512	0.	164	0.	3334	0.
	9999	35.1200	0.	0	0.	0	0.
	9583.4531	0	0. %	0. %	0.	0. %	0.
	9249	.016855		0.		95.312 %	
SMTBMS	$ 18000.00	1200	0.	0	0.	1200	0.
	9999	12.0000	0.	0	0.	0	0.
	9853.6328	0	0. %	0. %	0.	0. %	0.
	9727	.049222		0.		100.000 %	
MISSLS	$ 14000.00	512	0.	26	0.	471	0.
	999	5.1200	0.	0	0.	0	0.
	929.1624	0	0. %	0. %	0.	0. %	0.
	876	.115497		0.		94.769 %	
CAMERA	$ 2600.00	111	0.	113	.081268	0	0.
	99	1.1100	0.	0	.063056	0	0.
	101.6075	0	0. %	0. %	.006548	0. %	0.
	99	.536363		0.		0. %	

FIGURE A-26. S.P. 3.5's PARTS POST PROCESSOR OUTPUT (IBM)

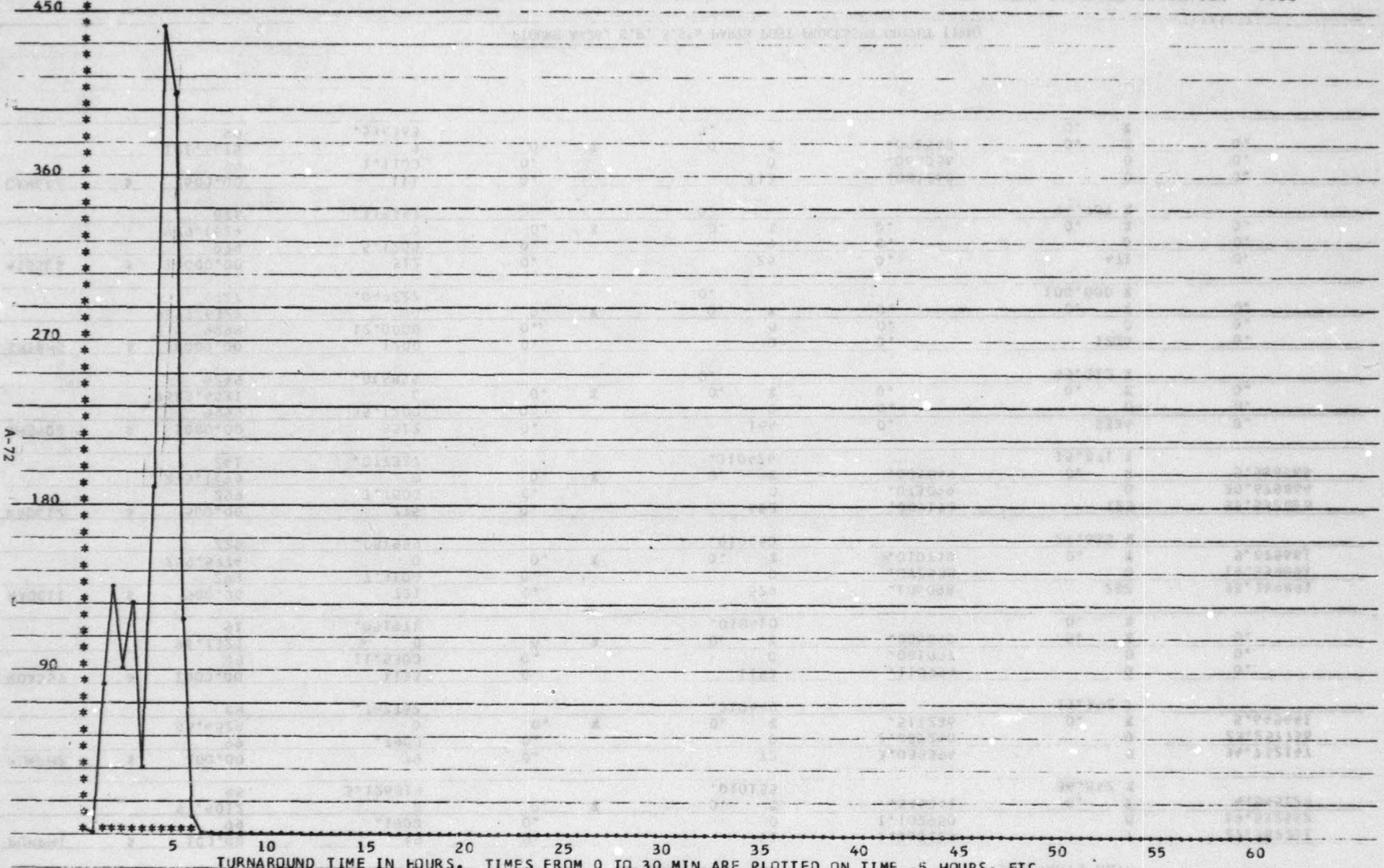


FIGURE A-27. S.P. 3.5's POST SORTIE TURNAROUND HISTOGRAM (IBM)

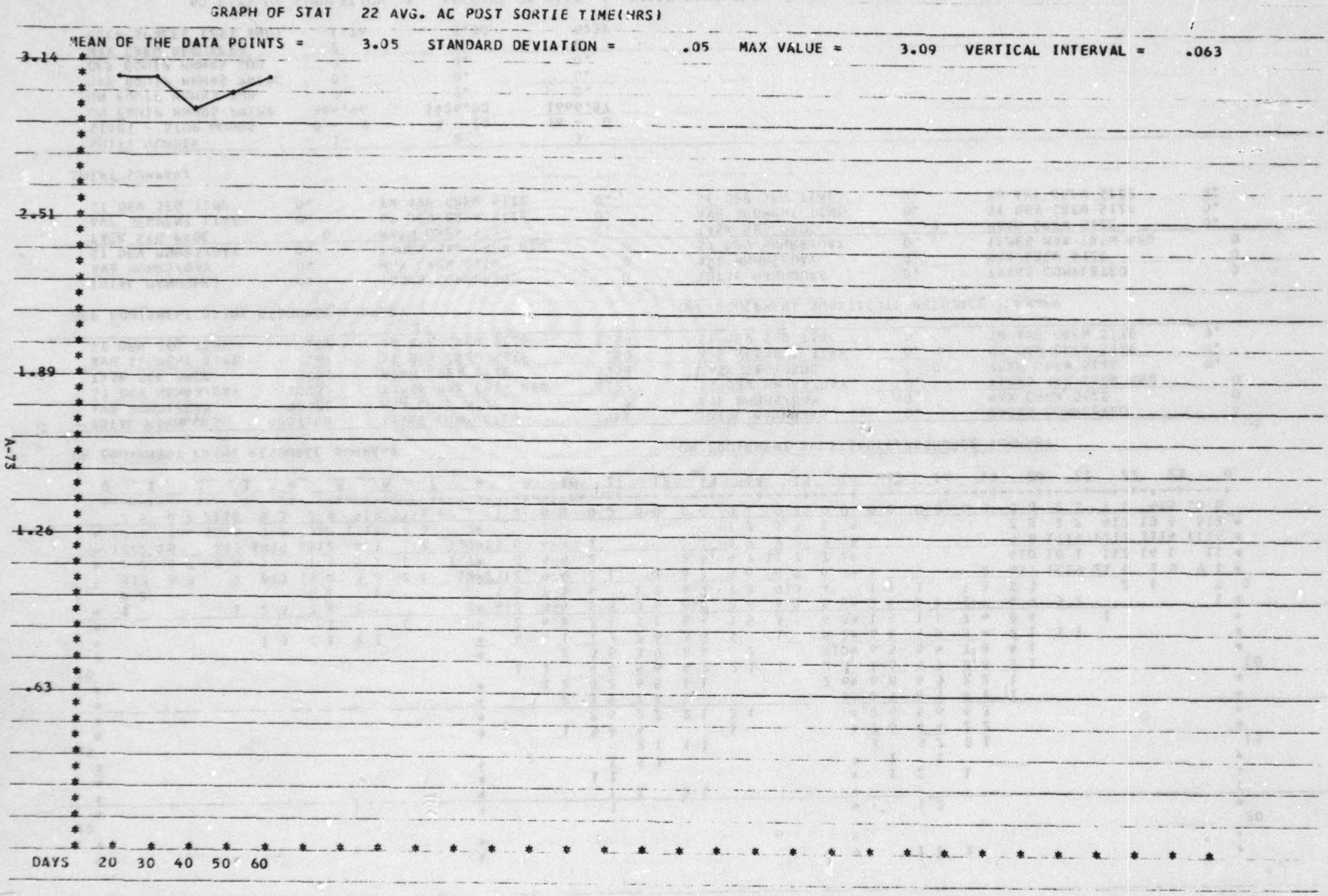
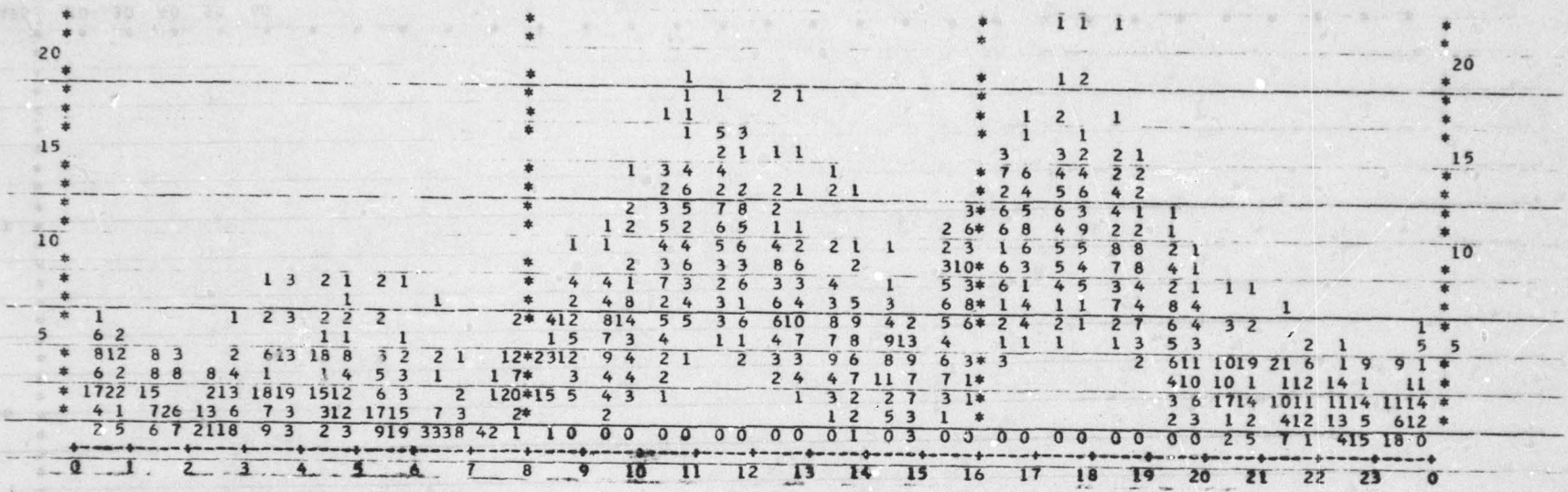


FIGURE A-28. S.P. 3.5's Graph of Stat 22 (IBM)

PRODUCTIVE UTILIZATION MATRIX FOR RESOURCE COMTEC (7)



ON EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	4057.58	TASKS COMPLETED	3833		
AVE MNHRS/DAY	92.22	MAX CREW SIZE	2		
ST DEV MNHRS/DAY	10.33	TIMES MAX CREW REQ	2127		
TASK SEG PROC	3833	MEAN CREW SIZE	1.55		
AVE SEGMENT TIME	.67	ST DEV CREW SIZE	.50		
ST DEV SEG TIME	.37	TW AVE CREW SIZE	1.59		

ON EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

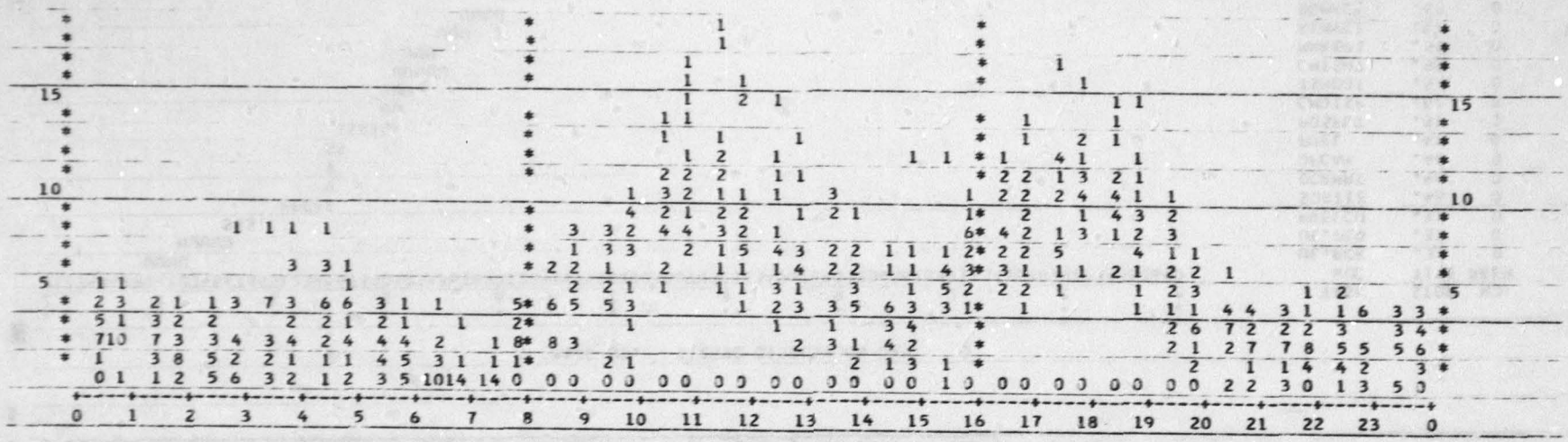
SHIFT SUMMARY

SHIFT NUMBER	1	2	3
START - STOP HOURS	0 - 8	8 - 16	16 - 0
ON EQUIP MNHRS PRIME	464.96	1926.00	1666.57
ON EQUIP MNHRS SUB	0.	0.	0.
OFF EQUIP MNHRS PRIME	0.	0.	0.
OFF EQUIP MNHRS SUB	0.	0.	0.
MAX CREW REQUIRED	2	2	2
LOOM SPACES (25% IND)	1.76	7.30	6.31

60 DAYS OF SIMULATION * 44 DAYS OF DATA * FIRST COMPLETE 5 DAY BLOCK STARTS DAY 0 REPEATS EVERY 7 DAYS

FIGURE A-29. S.P. 3.5's MANPOWER MATRIX (IBM)

PRODUCTIVE UTILIZATION MATRIX FOR RESOURCE COMTEC (7)



ON EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	1389.58	TASKS COMPLETED	1343
AVE MNHRS/DAY	86.85	MAX CREW SIZE	2
ST DEV MNHRS/DAY	10.13	TIMES MAX CREW REQ	739
TASK SEG PROC	1343	MEAN CREW SIZE	1.55
AVE SEGMENT TIME	.66	ST DEV CREW SIZE	.50
ST DEV SEG TIME	.37	TW AVE CREW SIZE	1.57

ON EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT PRIME RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

OFF EQUIPMENT SUBSTITUTE RESOURCE SUMMARY

TOTAL MANHOURS	0.	TASKS COMPLETED	0
AVE MNHRS/DAY	0.	MAX CREW SIZE	0
ST DEV MNHRS/DAY	0.	TIMES MAX CREW REQ	0
TASK SEG PROC	0	MEAN CREW SIZE	0.
AVE SEGMENT TIME	0.	ST DEV CREW SIZE	0.
ST DEV SEG TIME	0.	TW AVE CREW SIZE	0.

SHIFT SUMMARY

SHIFT NUMBER	1	2	3
START - STOP HOURS	0 - 8	8 - 16	16 - 0
ON EQUIP MNHRS PRIME	188.47	658.50	542.60
ON EQUIP MNHRS SUB	0.	0.	0.
OFF EQUIP MNHRS PRIME	0.	0.	0.
OFF EQUIP MNHRS SUB	0.	0.	0.
MAX CREW REQUIRED	2	2	2
LCCM SPACES (25% IND)	1.96	6.86	5.65

60 DAYS OF SIMULATION * 16 DAYS OF DATA * FIRST COMPLETE 2 DAY BLOCK STARTS DAY 5 REPEATS EVERY 7 DAYS

FIGURE A-29. S.P. 3.5's MANPOWER MATRIX (IBM) cont'd

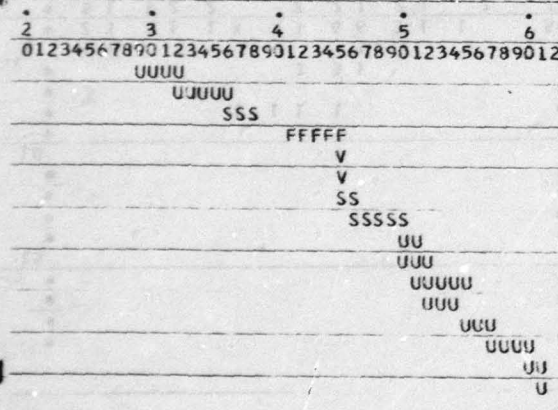
SPEC IN=7

SYMBOL	MEANINGS	SYMBOL	MEANINGS
B	OFF-EQUIPMENT ACTIVITIES	U	UNSCHEDULED MAINTENANCE
C	CONDEMNED	V	SERVICE TASK
D	DEPOT ACTIONS	*	ILLEGAL
F	ACTUAL FLIGHT	+	ILLEGAL
L	IMPOSED DELAYS	-	ILLEGAL
S	SCHEDULED MAINTENANCE		

912592

.3000	909648	81	.3229	2
.3229	917112	85	.3691	2
.3691	909438	2	.3811	3
.4167	910368	3	.4583	1
.4583	915072	5	.4583	5
.4583	909808	94	.4583	5
.4583	909648	4	.4654	3
.4654	910768	6	.5069	3
.5069	909968	47	.5151	2
.5069	914656	25	.5252	2
.5252	909808	26	.5460	2
.5151	909488	48	.5518	2
.5518	914656	50	.5714	2
.5714	915152	51	.6046	2
.6046	909488	52	.6110	2
.6110	913456	53	.6110	2

*A/C NO. 912592 DISPLAY ON DAY 0



TASK WUC	STOP TIME	NO. PREM
UL.RCK	.32	0
UL.POD	.37	0
PRELCH	.38	0
SORTIE	.46	0
DCRMNT	.46	0
DFCAM	.46	0
FUEL	.47	0
POSFLT	.51	0
CMDISP	.52	0
TSHOOT	.53	0
CMTSHT	.55	0
MNREP1	.55	0
REMVC1	.57	0
BCHKC1	.60	0
TRANC1	.61	0
REPLC1	.61	0

FIGURE A-30. S.P. 3.5's SAMPLE A/C DISPLAY (IBM)

911448

16.3958	936384	1	16.9375	3
16.9375	918656	2	16.9503	3
17.0000	919024	3	17.1138	1
17.1138	925184	5	17.1138	5
17.1138	918656	4	17.1209	3
17.1209	919024	6	17.1635	3
17.1635	918656	47	17.1756	2
17.1756	910608	48	17.2177	2
17.2177	919312	50	17.2377	2
17.2177	927576	49	17.2606	2
17.2377	925104	51	17.2796	2
17.2796	931208	52	17.2910	2
17.2910	923384	53	17.2910	2

*A/C NO. 911448 DISPLAY ON DAY 16

```
8        9        0        1        2        3        4        5        6        7        8
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
         SSSSS
           SSS
                  FFFFFFFFFFFF
                           V
                          SS
                           SSSSS
                              UU
                                UUUUU
                                  UUU
                                 UUUUUU
                                   UUUUU
                                     UUU
                                      U
```

TASK WUC	STOP TIME	NO. PREM
PREFLT	16.94	0
PRELCH	16.95	0
SORTIE	17.11	0
DCRMNT	17.11	0
FUEL	17.12	0
POSFLT	17.16	0
CMDISP	17.18	0
CMTSHT	17.22	0
REMVC1	17.24	0
CMMNRP	17.26	0
BCHKC1	17.28	0
TRANC1	17.29	0
REPLC1	17.29	0

FIGURE A-30. S.P. 3.5's SAMPLE A/C DISPLAY (IBM) cont'd

MISSION SUCCESS STATISTICS — RUN NUMBER SP3.5U — PAGE 89

LEVEL 2 REPORT — FROM .1 TO 60.0

MSN/ACT NAME	TIME SCHED	SIZE MAX	SIZE MIN	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	PCT	TAKEOFF LATE	PCT
PREFLT	300	16	0	4	4	1.000	64	64	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	17	0	23	23	1.000	391	391	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	18	0	21	21	1.000	378	378	1.000	0	0	0	0	0	0	0	0	0.	0	0.
PREFLT	300	19	0	12	12	1.000	228	228	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	600	2	2	60	60	1.000	120	120	1.000	0	0	0	0	0	0	0	2	.017	0	0.
INTRD3	700	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	800	4	3	60	60	1.000	240	240	1.000	0	0	0	0	5	0	0	0	0.	0	0.
INTRD1	830	2	2	60	60	1.000	120	120	1.000	1	4	0	0	0	0	55	1	.008	0	0.
RECON	1000	2	2	60	60	1.000	120	120	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY1	1030	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
INTRD1	1230	2	2	60	60	1.000	120	120	1.000	1	11	0	0	0	0	48	8	.067	2	.017
CLSPT1	1320	3	2	60	60	1.000	180	177	.983	0	3	0	0	0	0	0	0	0.	0	0.
INTRD2	1400	2	2	60	60	1.000	120	120	1.000	1	17	0	0	2	0	42	46	.383	4	.033
RECON	1500	2	2	60	60	1.000	120	120	1.000	0	20	0	0	0	0	40	52	.433	8	.067
RECON	1600	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	3	.050	1	.017
RECON	1800	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2000	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
RECON	2200	1	1	60	60	1.000	60	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
FERRY2	2400	2	2	60	60	1.000	120	120	1.000	0	0	0	0	0	0	0	0	0.	0	0.

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MISSION SUCCESS STATISTICS — RUN NUMBER SP3.5U — PAGE 90

LEVEL 2 SUMMARY REPORT — FROM .1 TO 60.0

MISSION IDENT	MISSIONS ATTD	MISSIONS FLOWN	MISSIONS PCT	SORTIES ATTD	SORTIES FLOWN	SORTIES PCT	DAYLIGHT SORTIES ATTD	PCT	DAYLIGHT SORTIES FLOWN	PCT	SORTIES LOST TO MND	GAB	SAB	OTH	AIR ABT	PLU GS	SPA RES	NO ACFT AT FRAG	PCT	TAKEOFF LATE	PCT
PREFLT	60	60	1.000	1061	1061	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.
RECON	420	420	1.000	600	600	1.000	420	.700	420	.700	0	20	0	0	0	0	40	57	.095	9	.015
INTRD3	60	60	1.000	60	60	1.000	60	1.000	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT2	60	60	1.000	240	240	1.000	240	1.000	240	1.000	0	0	0	0	5	0	0	0	0.	0	0.
INTRD1	120	120	1.000	240	240	1.000	240	1.000	240	1.000	2	15	0	0	0	0	103	9	.037	2	.008
FERRY1	60	60	1.000	60	60	1.000	60	1.000	60	1.000	0	0	0	0	0	0	0	0	0.	0	0.
CLSPT1	60	60	1.000	180	177	.983	180	1.000	177	1.000	0	3	0	0	0	0	0	0	0.	0	0.
INTRD2	60	60	1.000	120	120	1.000	120	1.000	120	1.000	1	17	0	0	2	0	42	46	.383	4	.033
FERRY2	60	60	1.000	120	120	1.000	0	0.	0	0.	0	0	0	0	0	0	0	0	0.	0	0.

FIGURE A-31. S.P. 3.5's MISSION POST PROCESSOR OUTPUT (IBM)

MODEL SUPPORT EQUIPMENTS DEMANDS

RESOURCE ID 10 ON -EQUIPMENT

```
4 +                                                
```

ACTUAL SUPPORT EQUIPMENT DEMANDS

RESOURCE ID 10 ON -EQUIPMENT

```
 4 +                                                
```

Appendix B

Input Module Diagnostic Messages

All user and programmer oriented messages described in this appendix have the same message numbers that are printed on the input module runs, for ease of reference to these descriptions. However, there are some internal programmer messages generally used for implementation checkouts that will not have message numbers. Users will see these messages only if a serious data or program problem has occurred, in which case, the AFMSMET programming staff should be contacted.

INPUT MODULE DIAGNOSTICS
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
1	THE FOLLOWING RESOURCES WERE NEVER REFERENCED. (CHECK)	I	EXP - Each resource in the list following this statement has been defined on Form 13 but was not referenced (used) on Form 12 or Form 17. COR - Either remove resource name from Form 13, or add its use in task definitions (Form 12), or if resource is an A/C see that it is used on a mission or activity. (Form 17).
2	NO AIRCRAFT RESOURCE, TYPE I, WAS DEFINED (CHECK)	I	EXP - When completing Form 13 data, no type "I" resource (an aircraft) was defined. However, the input module will create a dummy non-aircraft resource whose ID will be six blanks. Therefore, if the initialization tape produced under these conditions is to be used in an LCOM simulation, the corresponding exogeneous events tape (produced by processing Form 20 through the input module) may only process a non-aircraft resource with a blank ID. COR - To use this default, non-aircraft resource, "blank", the aircraft ID (Col 20-25) on Form 20 must be left blank. Otherwise, if a valid aircraft ID is to be used on the Form 20, enter it on Form 13 as an "I" type resource and rerun the initialization.
3	THE FOLLOWING RESOURCES ARE UNDEFINED. (CHECK)	F	EXP - The resources named in the list following this statement were referenced on either Form 12 or Form 16, or both, but not defined explicitly on Form 13. Note: This is a total list of all resources individually described by embedded diagnostic message number 15. COR - Define the resource on Form 13 or delete from Form 12 and/or Form 16. If the resource and the related task(s) are not to be retained in the data package, assure removal of the applicable portion of the task networks (Form 11).
4	THE FOLLOWING TASKS WERE NOT IN THE TASK NET WORK. (CHCK1)	I	EXP - The list of tasks appearing after this heading were defined on Form 12 but never referenced on Form 11. COR - Delete task definition from Form 12, or add proper task network to Form 11. Note: When adding network, assure completion of all related forms.

5	THE FOLLOWING TASKS ARE UNDEFINED. (CHCK1)	F	EXP - The list following this diagnostic contains the names of tasks referenced on either Form 11 or Form 14 but not defined on Form 12. Note: This is a total list of tasks individually described by embedded diagnostic messages #15. COR - Define the task on Form 12 or remove the applicable portion of the task network (Form 11 and Form 14).
6	NO MISSION ENTRY POINTS HAVE BEEN SPECIFIED. (CHCK1)	F	EXP - No Form 17 data has been submitted; therefore, the network cannot be processed. COR - Complete Form 17 data for the designated mission types and the necessary connecting task networks (Form 11). Note: When adding Form 11 cards, assure all other supporting forms are added as required, i.e., task definitions, etc.
7	ENTRY POINTS NOT SPECIFIED OR NODES UNDEFINED FOR THE FOLLOWING MISSIONS. (CHCK1)	F	EXP - This diagnostic indicates that for the following mission names, the nodes specified for entry points on Form 17 were not explicitly defined on a Form 11. COR - Check mission names to determine if they will be entered on Form 20. If so, develop connecting links on Form 11. Note: When adding Form 11 cards assure all other supporting forms are added as required, i.e., task definitions (Form 12), etc.
8	THE FOLLOWING RESOURCES ARE NOT REFERENCED IN THE TASK NETWORK-FAILURE WILL NOT OCCUR. ICHCK1)	I	EXP - The clocks ("C" type resources) listed after this diagnostic were legally defined on Form 13 cards or erroneously used on Form 14 cards, but were not referenced on Form 11 cards as a selection parameter for some "F" selection mode entry. COR - Delete clock name from Form 13, or if illegally used on Form 14, delete from Form 14, or add as a selection parameter ("F" selection mode) to an existing applicable task network (Form 11), or add appropriate task network (Form 11). Note: If retained, ensure that the clock name is properly decremented on Form 14.
9	NO FAILURE RATES PROVIDED FOR THE FOLLOWING RESOURCES-FAILURE WILL NOT OCCUR. (CHCK1)	I	EXP - This list contains resource clocks ("C" type resources) referenced on Form 11 but not defined on Form 13, or those clocks erroneously used on a Form 14. COR - Define clock on Form 13 or remove applicable portion of task networks (Form 11). Note: If Form 11 cards are removed ensure Form 12 cards with same task name are removed. Also review applicable portion of Form 14 to ensure that information described is as intended by the user.

INPUT MODULE DIAGNOSTICS
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
10	NO CLOCK DECREMENTS PROVIDED FOR THE FOLLOWING RESOURCES FAILURE WILL NOT OCCUR. (CHCK1)	I	EXP - Each clock ("C" type resource) in the list following this heading was either not included on Form 14 cards, or columns 21-26 were left blank on respective Form 14 entries. This condition does not prevent the model from processing. However, those resource clocks listed will not be operative. Note: This is a total list of clocks individually described by embedded diagnostic #30. COR - Add clock name to Form 14 in proper relation to its task ID (Decrementing task) and decrement value. The decrementing task and decrementing value may be either included on the specific card for the resource ID (clock name), or on a single card which is the first card in a constant segment. Then add proper decrementing value to decrement field (Columns 21-26) of the card which cntains the resource ID. Note: Refer to comment pertaining to imbedded diagnostic number 30.
11	E-MODE BRANCHES FROM THE FOLLOWING NODES DO NOT SUM TO 1.0 (CHECK)	I or F	EXP - The E selection mode branches that sum to either less than 1.0 (info) or greater than 1.0 (fatal) are listed here indicating the node from which they emanate. NODE PARAM SUM TOTAL BRANCHES XXXX XX.XXX XX COR - Ensure that the E branches whose sum is greater than 1.0 are corrected. Also verify those E branches whose sum is less than 1.0 to insure user intent is followed, i.e., the difference between the sum and 1.0 is the percent of the time nothing will happen at that node.
12	FORM 14 NOT SUBMITTED-FAILURE MECHANISM INOPERATIVE. (CHCK2)	I	EXP - This message only serves as a warning that no failure clocks can be referenced in the network since none have been defined. COR - When using "F" selection mode and clocks as failure parameters on Form 11, assure completion of Form 13 and Form 14.
13	EMBEDDED BLANKS CHECK DATA FOR MAT. (EVALUATE. FIELD)	D	EXP - One of the data fields in the card preceding this comment contains internal blanks. The internal blanks will be interpreted as zeros. Internal blanks are blanks between integers or between a decimal point and an integer. COR - Ensure that the field(s) with internal blanks contain the desired value. It is recommended that all embedded blanks be removed.

14	INVALID NUMERIC FIELD. (EVALUATE FIELD)	D	EXP - This message indicated that a data field in the preceding card contains illegal special or alpha characters. A zero is assumed. COR - Correct entry in numeric field.
15	UNDEFINED XXXXXXXXXXXX XXXXXX (HASH. INDEX)	D	EXP - The specified item was not defined, but an attempt was made to use the item. COR - Either define the item on the correct form or remove the item that was to be used. Misspelled names are a major cause of this message.
16	WARNING: REDEFINING DEFAULT SEARCH PATTERN MUST INCLUDE ALL CONFIGURATIONS AND STATUSES FOR THIS A/C. THE ORDER IS INSIGNIFICANT. (21.INPSP)	D	EXP - The default search pattern for each aircraft (same name as the aircraft) will be used when a search pattern is not defined for a mission on the Form 17. When this default search pattern is not defined on Form 21 by the user, the input module will define it automatical using the configurations, in order, from the configuration dictionary. COR - Check the default search pattern that is defined on the Form 21 to ensure all classes are used.
17	FORM 11 NODE USAGE REPORT (CHECK)	I	EXP - This is a table which indicates the number of times each node is used and the purpose for which the node is used, i.e., entry node, prior node, next node, etc. Also indicated are several error conditions which include undefined nodes, unused nodes, apparent static loops, unreachable nodes, parallel sorties, call sections that reach sorties, reconfiguration entries that reach sorties, conditional sorties, and sequential sorties. COR - This table can be used to find invalid or misspelled nodes, as well as aid in detecting errors in the Form 11, Form 17, Form 19, or Form 22. Review each node name and the applicable task network (Form 11). Ensure that the Form 17 data is correct and is what the user intended. Refer to Chapter III under the description of the Node Usage Report for possible corrective actions for the error conditions of undefined nodes, unused nodes, apparent static loops, unreachable nodes, parallel sorties, call sections that reach sorties, reconfiguration entries that reach sorties, conditional sorties, and sequential sorties.
18	THE MAX.NBR OF RESOURCES ALLOWED ON A SHIFT HAS BEEN EXCEEDED (16.INPSHF)	F	EXP - Too many different resources were placed on one of the shifts. COR - Verify the shift data in Form 16.

INPUT MODULE DIAGNOSTICS
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
19	TASK ID USED TWICE IGNORED (14.INPDEC)	W	EXP - A second Form 14 contains a task name previously used. COR - Move all clocks for the same task under one occurrence of the task and remove the duplicate task name.
20	REDEFINITION OF CLOCK DECREMENT IGNORED. (14.INPDEC)	W	EXP - Three conditions can cause this message, they are: (1) A clock decrement was placed in the Form 14 on a clock within a list of clocks to be decremented by either the sortie or a constant value; (2) A clock has been entered more than once for the same task; and (3) This message is printed along with MSG 19 as an extra caution. COR - To fix condition (1), either change the mode of the decrementing (on first Form 14 containing the task name) or eliminate the decrement value. To fix condition (2), eliminate extra occurrences of the same clock on the same task.
21	INVALID CARD SUBTYPE IN ABOVE (10.INPUTR)	D	EXP - Form 10 card subtypes 2, 4, 6, 8, 10, and 12 are no longer needed. The model counts the user defined headings and provides one additional column in the PSR. COR - Either do nothing or delete the heading dimension subtypes.
22	MEAN FIELD BLANK FOR CLOCK RESOURCE (13.INPRES)	W	EXP - Clock has no mean reset value on Form 13. COR - Either add the mean clock value or clock will not fail.
23	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED

24	THE FOLLOWING NODES ARE B-MODE CONSTRAINED (CHECKS)	I	EXP - The nodes listed here are those that have more than one task leading to them which must be completed prior to the listed tasks starting. Selection mode for the tasks listed is "B". The "B" selection mode must not be used when there is a possibility of the "B" task being in parallel with another branch of the network. When it is necessary to constrain tasks, it is more desirable to use a "C" selection mode to call a sub network which contains all tasks that would lead to the constrained task. The node prior to the constrained task would be the next node of the call statement. The sub network is an effective constraining mechanism which causes all work in the called section to be completed before the node prior to the constrained task is reached. COR - Review the list of constrained tasks against the applicable networks to insure that the constrained tasks are not in parallel with other portions of the network, and the use of the constraints depicts what the user intended.
25	MODE CHANGE ON CONTINUATION CARD IGNORED (14.INPDEC)	W	EXP - On Form 14 the mode by which the clocks are decremented are on clocks other than the first one listed. COR - If mode is truly different, the Form 14s must be corrected. If it is just a repeat of the same mode, it should be eliminated.
26	DECREMENT MUST NOT BE ZERO, 0.001 ASSUMED. (14.INPDEC)	W	EXP - On the Form As all decrements must be greater than zero. COR - Either place correct clock decrement value in or remove clock from list.
27	ONE OR MORE UN-DEFINED NODES FOUND-SEE NODE USAGE REPORT. **** (CHECK)	F	EXP - Self-explanatory COR - Correct Form 11s to insure undefined nodes are added, i.e., used as a prior node.
28	COL. 9 MUST BE EITHER I OR S-DISTN IGNORED (15.INPDBN)	W	EXP - Column 9 in the above Form 15 card is error. COR - Insert "I" or "S" in Col. 9 as appropriate.
29	EITHER A PROBA-BILITY OR A VALUE IS MISSING IN DATA SET X: PAIR DROPPED (15.INPDBN)	D	EXP - Each pair of probability and value fields must contain data or both fields of the pair must be blank. The probability field cannot contain data if the value field is blank, and the value field cannot contain data if the probability field is blank. COR - Insert appropriate data into the blank field of the pair, or delete the field with a value.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
30	CLOCK DECREMENT MISSING-RESOURCE WILL NOT FAIL (14.INPDEC)	W	EXP - The decrement field in the Form 14 card preceding this statement has been left blank. Note: Does not apply to "S" mode. Three conditions may cause this message, they are: (1) Clock name not included in proper segment of Form 14; (2) First card of a segment which contains the decrement value; and (3) Single card with decrementing task, Column 12 blank (mode) does not contain decrement value. COR - Review list of clocks to determine validity of referenced clock. If the clock is valid include the card containing the clock name or insert the decrementing value in the card containing the decrementing task as is appropriate
31	COST VALUES PROVIDED FOR THE FOLLOWING RESOURCES. (CHCK1)	I	EXP - A unit cost was not provided on the Form 13 for the resources listed. The input module will automatically provide a default unit cost. The default value is provided in the diagnostic list. Note: The dollar values of the resources are used in the simulation only when using the decision model. However, the summation of the value of 'P' and 'A' type resources is indicated in the performance summary on all runs. COR - If the default value is not acceptable, provide a unit cost on the Form 13.
32	SELECTION PARAMETER GREATER THAN 1.0-SET TO 0. (11.INPNET)	W	EXP - The selection parameter field on the preceding Form 11 was in error. COR - Insert proper selection parameter. Note: When a quantity greater than 1.00 is desired on an "A" selection factor, it may be obtained by inserting more than one card, node to node, with selection parameter values of 1.00 or less until the sum of all parameters equals the desired value.
33	CUMULATIVE PROBABILITY FOR DISTRIBUTION NO. 'XX' EXCEEDS 1.0 (15.INPDBN)	W	EXP - On the Form 15, the cumulative probability for the designated empirical distribution is greater than 1.0. COR - Correct the definition of the empirical distribution so that the total probability is exactly 1.0.
34	SHIFT AUTHORIZATION VALUE BLANK, ZERO ASSUMED. (16.INPSHF)	W	EXP - No authorization value provided. COR - Model assumes zero. Correct Form 16 entry if appropriate.

35	SHIFT AUTHORIZATION IGNORED NO CORRESPONDING DURATION FOUND (16.INPSHF)	W	EXP - On Form 16, no shift duration entered. All shift authorization values corresponding to this shift period are ignored. COR - When eliminating a shift duration ensure the corresponding authorizations are also eliminated.
36	THE FOLLOWING NODES WERE DEFINED AS T SELECTION MODES, BUT NEVER USED ON FORM 22 - CHANGED TO D (CHECK)	I	EXP - A node in the Form 11 that used a trigger "T" selection was not defined on Form 22 in terms of either incrementing or decrementing a piece of internal equipment. COR - Either (1) Define the node as a trigger node on Form 22, (2) Use a different selection mode in the Form 11 network, or (3) Accept the input module assumption that you wanted a D mode.
37	INVALID SELECTION MODE-ASSUME D (11.INPNET)	W	EXP - Column 9 on LCOM Form 11 preceding this comment has an illegal selection mode type; the input module will assume that this task is a "DO" task. COR - Insert proper selection mode if DO is not satisfactory.
38	ABOVE CARD WITH BLANK PRIOR NODE AND TASK NAME IS IGNORED. (11.INPNET)	W	EXP - A bad Form 11 card was found. It could have been partially blank card or off punched card. COR - Correct the Form 11s at the point of error message.
39	G MODE PARAMETER 0.0, CHANGED TO 0.001 (11.IPNET)	W	EXP - G selection mode parameters cannot be zero, one was found. COR - Correct the G mode selection parameter in the Form 11s.
40	BAD RESOURCE TYPE-ASSUME PART (13.INPRES)	W	EXP - Column 12 on the preceding Form 13 contains an invalid resource type; the input module assumes the resource is a part. COR - Insert proper resource type in Column 12 if part is not correct.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
41	REPORT COLUMN EXCEEDS NO. OF HEADINGS-SET TO XXX. (13.INPRES)	W	EXP - Not enough report columns were defined on Form 10, or the report column field on the preceding Form 13 card is erroneous. The input module sets the report column for the preceding Form 13 card to one more than the number requested on the Form 10. This extra column is always provided and is set aside for defaulting purposes. Users may take advantage of this by not defining a column for a specific resource. If no report col. is given on Form 13, the data will be entered in this extra column. COR - Add missing column headings to Form 10 or correct entry in 'Report Column' field of Form 13, if necessary.
42	BAD TASK TYPE SET TO OTHER (12.INPTSK)	W	EXP - Column 12 contains all illegal codes in the card preceding this diagnostic. The input module will set the task type to 5 (this is the code to designate "Other"). COR - Insert proper task type in Column 12.
43	NO PRIORITY ASSIGNED, TOP OF CATEGORY III SHALL BE USED (12.INPTSK)	W	EXP - Column 13 in the Form 12 preceding this comment was left blank. The default priority established by the input module is the highest value available for Category III tasks. Category III tasks are defined on the Form 18. COR - Insert proper priority in Column 13.
44	RESOURCE XXXXXX USED TWICE-IGNORED (12.INPTSK)	W	EXP - On preceding card, the resource was specified more than once for a task I.D. on the Form 12, i.e., the resource was found more than once in the task resource requirements fields of the Form 12 for a specific task I.D. COR - Eliminate any duplicate cards, or, in the case of an identical resource for a task I.D., eliminate duplicate entry and adjust quantity as required.
45	QUANTITY FIELD BLANK-ASSUME 1 (12.INPTSK)	W	EXP - The "QTY" field on the Form 12 preceding this diagnostic being blank, the input module assumes a quantity of 1 for the resource(s). COR - Insert correct quantity in applicable "QTY" field.

46	NOT ENOUGH TAKE-OFF TIME RECORDS (20.MREAD)	W	EXP - An 'R' has been found in the 'Takeoff Time' field indicating that records which follow contain only takeoff times, all other data normally on the card is assumed to be a duplicate of the data on the card with the 'R' in the takeoff time field. The number of takeoff times (cards) must exactly equal the number found in the number of missions field. If too few takeoff times are found, this message will appear. Note: This mission will be eliminated from the flying program. COR - Add the missing takeoff times to the Form 20 data or adjust the entry in the number of missions field.
47	THE FOLLOWING CLOCKS HAVE UN-DEFINED EMPIRI-CAL FAILURE RATE DISTRIBU-TIONS. (CHECK)	F	EXP - When attempting to use an empirical distribution, the assigned distribution number placed in the field labeled 'Mean' on the Form 13 has not been defined; that is, the distribution number was not found as a distribution I.D. on the Form 15. COR - An empirical distribution with the mission distribution I.D. must be added to the Form 15, or an empirical distribution already defined on the Form 15 may be used.
48	THE FOLLOWING TASKS HAVE UNDE-FINED EMPIRICAL TASK DURATION DISTRIBUTIONS. (CHCK1)	F	EXP - When attempting to use an empirical distribution, the assigned distribution number placed in the field labeled 'mean' on the Form 12 was not defined; that is, the distribution number was not found as a distribution I.D. on the Form 15. COR - An empirical distribution with the missing distribution I.D. must be added to the Form 15, or an empirical distribution already defined on the Form 15 may be used.
49	CLASS XXXX NOT DEFINED FOR THIS AIRCRAFT-PAIR SKIPPED. (21.INPSP)	W	EXP - The following external configurations/classes were used on the Form 21, but not defined on the Form 17. COR - Define the missing external configurations/classes on the Form 17 or eliminate its use on the Form 21.
50	THE FOLLOWING CONFIGURATIONS ARE NOT REFER-ENCED IN THE SEARCH PATTERNS FOR THEIR A/C. (CHCK1)	F	EXP - The following external configurations/classes were defined on the Form 17 but were not referenced on the Form 21. COR - Add the missing external configuration/class to the Form 21 Search Patterns or remove the external configuration/class definition from the Form 17.
51	THE FOLLOWING SEARCH PATTERNS ARE NOT DEFINED. (CHCK1)	F	EXP - The following aircraft assignment search patterns were used on the Form 17 but were not defined on the Form 21. COR - Define the aircraft assignment search pattern on the Form 21.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
52	SEARCH PATTERNS NOT PREVIOUSLY USED WITH AN A/C ON FORM 17 IGNORED (22.INPSP)	W	EXP - The following aircraft assignment search patterns were defined on the Form 21 but were not used on the Form 17. COR - Either use the missing aircraft assignment search pattern on Form 17 or remove the definition of the search pattern from the Form 21.
53	CLASSES WITH ZERO OR SMALL SEARCH FREQUENCIES MAY CAUSE A/C QUEUING PROBLEMS. (CHCK2)	I	EXP - This is a warning to stress the point that aircraft which end up in external configurations/ which are not searched very often, may effectively be "lost" as aircraft available to fly missions which require other external configurations/classes of aircraft. COR - Ensure (where possible) that all external configuration/classes are searched in several or all aircraft assignment search patterns (Form 21).
54	THE FOLLOWING INTERNAL EQUIPMENT GROUPS WERE USED ON FORM 21, BUT NOT DEFINED ON FORM 23 (CHCK1)	F	EXP - These internal equipment groups were specified on Form 21 in the aircraft assignment search patterns, but were not defined on Form 23. COR - Either remove specific search entry on Form 21 using the external equipment group or define it on Form 23.
55	INTERNAL EQUIPMENT XXXXXX NOT DEFINED FOR THIS AIRCRAFT - IGNORED (23.INPIEL)	W	EXP - A piece of internal equipment specified as a part of an internal equipment group on Form 23 was not defined on Form 22. COR - Insure that all Internal equipment to be grouped on Form 23 are defined with trigger nodes on Form 22.
56	XXXXXXXXXXXX PREVIOUSLY DEFINED-IGNORED. (22.INPTRG, 23.INPIEL, HASH.INDEX)	D	EXP - An item has been defined more than once on a form. The first definition is used and all others are ignored. COR - Remove all definitions of the item which are incorrect, leaving only the correct definition.
57	RESOURCE ID FIELD BLANK - ABOVE CARD IGNORED (13.INPRES)	F	EXP - Cols. 5-10 of the above Form 13 are blank. COR - Enter a resource ID in Cols. 5-10 of this Form 13.

58	COLUMNS 11-28 ARE NOT ALL BLANK - ABOVE CARD IGNORED	F	EXP - On a Form 13 continuation card, Columns 11-28 must be left blank. COR - Ensure only blanks are in Cols. 11-28 of a Form 13 continuation card.
59	COLUMNS 35-49 ARE NOT ALL BLANK - ABOVE CARD IGNORED (13.INPRES)	F	EXP - On a Form 13 continuation card, Columns 35-49 must be left blank. COR - Ensure only blanks are in Cols. 35-49 of a Form 13 continuation card.
60	COLUMNS 4, 56, 63, 70, 71, 72 ARE NOT ALL BLANK - ABOVE CARD IGNORED (13.INPRES)	F	EXP - Columns 4, 56, 63, 70, 71, and 72 must be blank on a Form 13 continuation card. COR - Ensure that Columns 4, 56, 63, 70, 71, and 72 are all blank on the above Form 13.
61	ISTAR FIELD IS NOT BLANK OR *, ASSUME *. (12.INPTSK)	W	EXP - A character other than an * was found in Column 29 on Form 12. COR - Only an * is legal in this field. Possible off punched data record.
62	TASKS FROM NODE XXX INCONSISTENT G SELECTION MODE MUST NOT BE MIXED WITH ANY OTHER TYPE. (11.VERIFY)	F	EXP - Since the 'G' selection mode ensures that at least one path is taken from a node, no other selection types can be used from the same node since they contradict the 'G' selection. All modes other than the G may be processed more than once. COR - Either change all selection modes emitting from a node to 'G' or remove the selection modes and use 'A' selection mode in its place. If probability of a G task = 1.0, then the task is changed to a D task.
63	DISTRIBUTION NO XXXX POINTS ARE IN ERROR-DISTRIBUTION DROPPED. (15.INPDBN)	W	EXP - This message is generated when no probability/value pairs are found for an empirical distribution on the Form 15. COR - Ensure that empirical distributions are defined on the Form 15 in the manner described in the LCOM User's Reference Manual-'Form 15-Distributions'.
64	BAD CARD TYPE IN 2ND CARD IN FRONT OF ABOVE OR INPUT CONTAINS 2 SETS OF FORM XXXs. (17.INPIET, 12.INPTSK, 21.INPSP, 22.INPTRG, 23.INPIEL)	F	EXP - After processing a 'set' of Form 12, 17, 21, 22, or 23 records (cards) and proceeding to process data from other forms, a misplaced Form 12, 17, 21, 22, or 23 record was found. COR - Determine if the misplaced record is valid and if so place it with the rest of its data.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
65	PRE-SORTIE CONFIGURATION BLANK BUT POST-SORTIE CONFIGURATION NON-BLANK (17.INPIET)	F	EXP - The Post-Sortie External Configuration field (Cols. 29-34) on Form 17 is non-blank but the Pre-Sortie External Configuration field (Cols. 22-27) has been left blank. COR - Either set the Post-Sortie Ext. Conf. field on the Form 17 to blanks or enter a configuration name in the Pre-Sortie Ext. Conf. field on the Form 17.
66	NO POST SORTIE CONFIGURATION DEFINED-ASSUME PRE-SORTIE CONFIGURATION (17.INPIET)	W	EXP - If the Post-Sortie Configuration (Cols. 29-34) on Form 17 has been left blank, the Pre-Sortie Configuration (Cols. 22-27) is assumed. COR - Define a Post-Sortie Configuration on the Form 17 if the substitution of the Pre-Sortie Configuration is not acceptable.
67	NO SEARCH PATTERN NAME SPECIFIED - ASSUME SEARCH PATTERN WITH SAME NAME AS AIRCRAFT (17.INPIET)	W	EXP - If a search pattern is not specified on the Form 17 for a mission entry point, the input module assumes that the default search pattern is required. Each aircraft has a default search pattern with the same name as the aircraft. This pattern can be modified by defining a search pattern on Form 21 with the same name as the aircraft. COR - Specify a search pattern on the Form 17 if the default search pattern is not acceptable.
68	REPORT COLUMN EXCEEDS NO. OF HEADINGS-SET TO "OTHER". (17.INPIET)	W	EXP - Not enough report columns were defined in the operations area on Form 10 or the report column field on the preceding Form 17 card is erroneous. The input module sets the report column for the preceding Form 17 card to one more than the number requested on the Form 10. This extra column is always provided and is set aside for defaulting purposes. Users may take advantage of this by not defining a column for a specific resource. If no report column is given on Form 17, the data will be entered in this extra column. COR - Add missing column headings to Form 10 or correct entry in 'Report Column' field of Form 17 if necessary.

69	REPORT COLUMN IS ZERO-SET TO "OTHER". (17.INPIET)	W	EXP - Mission report column was set to zero or was blank. COR - Correct report column if collection of this mission's statistics in the extra column is not satisfactory.
70	BAD CARD TYPE N 2ND CARD IN FRONT OF ABOVE CARD, OR INPUT CONTAINS TWO SETS OF FORM XXXs. (11.INPNET, 15.INPDBN, 16.INPSHF)	F	EXP - After processing a 'set' of Form 11, 15, or 16 records (cards) and processing data from other forms, a misplaced Form 11, 15, or 16 record was found. COR - Determine if the misplaced record was valid, and if so place it with the rest of its data.
71	DUPLICATE TO AND FROM NODES-BE VERY CAREFUL (11.INPNET)	W	EXP - The prior and next node on a Form 11 card have the same node name. This would be an infinite loop if not controlled by an A, F, or H selection mode. COR - Change one of the node names. Note: Assure proper node sequence (linking) is maintained when making the change and avoid unwanted duplication of node names.
72	TASKS FROM NODE XXX INCONSIS-TENT: R SELECTION MODE CAN ONLY BE MIXED WITH D-MODE (11.VERIFY)	F	EXP - Because of the method of processing an R selection mode (once thru list based upon resource availability then backorder first task) only D selection modes can be mixed. COR - Verify all branches emanating from the particular node. Comply with explanation. See corrective action for 62.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
73	BAD CARD TYPE IN 2ND CARD IN FRONT OF ABOVE CARD, OR INPUT CONTAINS 2 SETS OF FORM XXXs. (13.INPRES)	F	EXP - After processing a 'set' of Form 13 records (cards) and while processing data from other forms, a misplaced Form 13 record was found. COR - Determine if the misplaced record is valid, and if so place it with the rest of the Form 13 data.
74	CORRESPONDING '*' SHIFT DURATION CARD WAS NOT READ. REPETITION DELETED IN COLUMN XX (16.INPSHF)	F	EXP - A shift repetition card was read but no shift definition card was found. A shift definition card must immediately precede the shift repetition card. COR - Check for misplaced Form 16 cards; or add missing shift definition card; or remove extraneous shift repetition card.
75	ILLEGAL CHARACTER IN COL. 5 OF ABOVE CARD. (16.INPSHF)	F	EXP - A character other than the asterisk, used to denote a new shift policy or an "R", used to denote the number of times the particular shift policy is to be repeated, appears in Col. 5 of the preceding card. COR - Review the listing of Form 16s to determine the appropriate character required in Col. 5.
76	NO RESOURCE ID ON ABOVE SHIFT-AUTH CARD-CARD DELETED (16.INPSHF)	W	EXP - The input module will not process a shift authorization card (Form 16) that does not contain a resource ID. COR - Place a resource ID in the above card.
77	ABOVE RESOURCE ALREADY ON A SHIFT CARD DELETED (16.INPSHF)	W	EXP - This message is caused by defining the same resource on more than one shift pattern, for example, assigning a particular resource to a 24 hour per day shift pattern and then defining the same resource again on an 8 hour shift pattern. COR - Review the list of resources treated on the Form 16s to determine which resource is being duplicated and determine the correct shift pattern for this resource.

78	CORRESPONDING SHIFT DURATION CARD WAS NOT READ ABOVE SHIFT AUTHORIZATIONS DELETED. (16.INPSHF)	W	EXP - A shift authorization card was read but no shift definition card was found. The shift authorization card(s) must have a preceding shift definition card. COR - Check for misplaced Form 16 cards; or, add missing shift definition card; or remove extraneous shift authorization card.
79	THE FOLLOWING CLOCKS HAVE MEANS LESS THAN OR EQUAL TO THE VARIANCE OR NON-ZERO VARIANCES AND A 'C' DISTRIBUTION (CHECK)	I	EXP - This message can indicate a questionable or a fatal condition regarding the distributions used on the Form 13s for the clocks listed. Constant, 'C', distributions with non-zero variances are listed. All distributions other than empirical and constant are listed if the variance is greater than or equal to the mean or if the variance is less than or equal to zero. This message is fatal if either a normal or a lognormal distribution has a zero variance. COR - Correct the Form 13s such that constant distributions have zero variances (Col. 42-47) and all other distributions listed have a positive non-zero variance less than the mean (Col. 36-41).
80	THE FOLLOWING TASKS HAVE MEANS LESS THAN OR EQUAL THE VARIANCE OR NON-ZERO VARIANCES AND A 'C' DISTRIBUTION (CHK1)	I	EXP - This message can indicate a questionable or fatal condition regarding the distributions used on the Form 12s for the tasks listed. Constant, 'C', distributions with non-zero variances are listed. All distributions other than constant, triangular, and empirical are listed if the variance is greater than or equal to the mean or if the variance is less than or equal to zero. This message is fatal if either a normal or a lognormal distribution has a zero variance. COR - Correct the Form 12s such that constant distributions have zero variances (Col. 21-26) and all other distributions listed have a positive non-zero variance less than the mean (Col. 15-20).
81	ABOVE CARD OUT OF PLACE IGNORED. (21.INPSP, 22.INPTRG, 23.INPIEL)	W	EXP - Invalid search pattern names on a Form 21, invalid aircraft names on a Form 22, invalid internal equipment group names on a Form 23, or invalid continuation flags on any of these forms have been found. COR - On the Form 21, either the above card needs its continuation flag changed (Col. 11) or, a card with a blank search pattern name was found, or the search pattern name on a continuation card does not match the previous cards. On the Form 22, either the above card needs its continuation flag changed (Col. 11) or the aircraft name on a continuation card does not match the previous card's aircraft name. On the Form 23, either the above card needs its continuation flag changed (Col. 11), or the internal equipment group name on a continuation card does not match the previous cards.

INPUT MODULE DIAGNOSTICS
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
82	CONTINUATION CARD ALSO IGNORED. (21.INPSP, 22.INPTRG, 23.INPIEL)	W	EXP - The card following an out of sequence card is a continuation card and must be ignored. See #81. COR - None.
83	A CLASS/CONFIG MISSING/GROUP SKIPPED (21.INPSP)	W	EXP - A reconfiguration class is blank but has an entry node defined. COR - Remove the invalid entry node or add the missing class.
84	TASK XXXXX HAS AN N OR L DIST AND ZERO VAR OR INVALID EXPONENTIAL (CHECK)	F	EXP - On the Form 12s for the tasks listed, a normal or lognormal distribution was specified with a zero variance or an exponential distribution was specified with a threshold constant greater or equal to the mean. COR - If the error involves a normal or lognormal distribution, correct the Form 12s so that the variance is non-zero or change the distribution type to constant. If the error involves an expenential distribution, adjust the mean and the threshold constant so that the mean is greater than the threshold constant.
85	EXTERNAL ENTRY NODE XXXXXX NON-BLANK; NOT PERUITTED WHEN PRE AND POST CONFIGS ARE BLANK (FORM 17) (21.INPSP)	F	EXP - A reconfiguration entry node has an entry in it on the Form 21, but this is not allowed because there was a Form 17 that used this aircraft assignment search pattern and had blank pre and post external configurations. With blank pre and post fields, the search pattern must not specify any external reconfiguration. COR - Either change the Form 17 to have non-blank pre and post config fields, or change the Form 21 if appropriate.
86	0 IS NOT A VALID CANCEL TIME, ASSUME BLANK (20.MREAD)	W	EXP - Cancel time (Cols. 60-63) on a Form 20 was set to zero. Blank is legal, but zero is not. COR - Set the cancel time to blank or some number other than 0.

87	CLOCK XXXXX HAS AN N OR L DIST AND ZERO VAR OR INVALID EXPONENTIAL (CHK1)	F	EXP - On the Form 13s for the clocks listed, a normal or lognormal distribution was specified with a zero variance or an exponential distribution was specified with a threshold constant greater or equal to the mean. COR - Correct the Form 13s so that the variance is non-zero or change the distribution type to constant if the error involves a normal or lognormal distribution. If the error involves an exponential distribution, adjust the mean and the threshold constant so that the mean is greater than the threshold constant.
88	INTERNAL EQUIPMENT GROUP PREVIOUSLY USED WITH ANOTHER AIRCRAFT, GROUP, XX, SKIPPED. (21.INPSP)	W	EXP - Internal equipment groups on the Form 21s must be unique by aircraft. COR - Make the internal equipment groups unique by aircraft on the Form 21s.
89	T DIST INPUT DATA ERROR IN ABOVE MISSION DELETED (20.MREAD)	W	EXP - Possible bad T distribution input or bad data was found in columns 75 thru 80. COR - Correct Form 20 record.
90	DISTRIBUTION NO XXXX NOT DEFINED. (20.DRAW, 20.MREAD)	W	EXP - An empirical distribution number has been found in the 'mean mission length' field of a Form 20 record which has not been defined on the Form 15. COR - Either define the empirical distribution desired on the Form 15 or correct the 'mean mission length' field.
91	ABOVE CARD IN ERROR (12.INPTSK)	F	EXP - This diagnostic is precipitated under various conditions when the input module is processing Form 12 data. First, it may mean that the task ID on either a Form 12 or a 12A is blank. Secondly, it may mean a card was just read on which the task ID was identical to the previous task ID but Col 11 did not contain a continuation code (any character other than blank). Thirdly, it could mean that a card with a continuation code was just read whose task ID did not correspond to the task ID on the preceding card. COR - There are four possible actions which will correct the condition depending on the prevalent situation: (1) Correct the task ID field, or, (2) Eliminate duplicate card, or, (3) Add "C" to Col. 11 of continuation card, or, (4) Reposition card to follow the basic card (same task ID) in the Form 12 segment of the data deck. Note: When more than one continuation card is used, make the first card read, the basic card, then all other continuation cards in succession (e.g., basic, continuation).

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
92	T DIST. INPUT DATA IN ERROR IN ABOVE CARD (12.INPTSK)	F	EXP - When defining "optimistic", "most likely", and "pessimistic" (OMP) data for a triangular (T) distribution, either optimistic time is greater than or most likely is greater than pessimistic, or optimistic time equals zero. COR - Correct the OMP data so that optimistic is less than most likely which should be less than pessimistic.
93	AN I SEL. MODE MUST ONLY BE USED WITH A TASK THAT CONSUMES PARTS ASSUME D. (11.INPNET)	W	EXP - On the Form 11, an I selection mode was used with a task that was not specified on the Form 12 as consuming a resource. COR - Specify the consumption of a resource by the task or use a D selection mode in place of the I selection mode.
94	NO SELECTION PARA METER WITH H SELECTION MODE ASSUME D. (11.INPNET)	W	EXP - A clock name must be provided on the Form 11 for each H selection mode. The clock name is placed in Cols. 27-32 of the Form 11. COR - Insert the clock related to the task or change the selection mode.
95	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
96	I SEL MODES MAY BE NEEDED IN THE NETWORK AS FOLLOWS: TASK USED CONSUMES A PART AND HAS A VALID DURATION. (CHECK)	I	EXP - This is a summary of Msg 95. COR - See Msg 95.

97	I SEL MODE ILLEGALLY USED AT THE FOLLOWING CONTROL TABLE LOCATIONS CHANGED TO D MODE. (CHECK)	I	EXP - An I selection mode may not be used on a task which does not consume a part. COR - Change the selection mode or indicate on the Form 12 that the task consumes a part.
98	BLANK DISTRIBUTION TYPE-ASSUME C. (12.INPTSK) (13.INPRES)	W	EXP - When no distribution is specified, the default is the "constant" distribution type. COR - Supply a distribution type if "C" is not the type required.
99	INVALID DISTRIBUTION TYPE-ASSUME C. (12.INPTSK) (13.INPRES)	W	EXP - The distribution type specified is not a valid type. COR - Supply a valid distribution type.
100	RESOURCE FIELD BLANK-PAIR IGNORED. (12.INPTSK)	W	EXP - In the above card, the quantity field is not blank but its related resource field is blank. COR - Supply a resource name or remove the value from the quantity field.
101	FORM 20 CARDS OUT OF SEQUENCE IN DAYS FIELD. PROCESSING STOPPED. (20.INPUT 9)	W	EXP - Form 20 record found with the day field (Col 5-7) smaller than on previous record. COR - Either the record found was incorrect in the day field or the previous record was incorrect. Check if either record had been entered with misalignedd fields.
102	S SELECTION (ONLY) MUST HAVE TYPE 1 TASK. NODE XXXX (CHECK)	F	EXP - Only sortie type tasks can be in the network with a selection mode (a 1 in Col. 12 of the Form 12) of S (an S in Col. 26 of the Form 11). COR - Ensure correct networking of sortie task and sortie network branches.
103	COLUMNS 43-48 MUST BE A DEFINED AIRCRAFT RESOURCE (17.INPIET)	F	EXP - A/C name must be entered in Col. 43-48 on Form 17. Resource specified was not defined as an A/C on a previous Form 13. COR - Place appropriate A/C name on Form 17 or ensure Form 13 precedes Form 17.

INPUT MODULE DIAGNOSTICS
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
104	AT CONTROL XXX TASK TYPE MUST BE SCHEDULED OR UNSCHEDULED MAINTENANCE AT NODE XXXXXX (CHECK)	F	EXP - Control XXX refers to the XXX row in the control table. Also the XXXth Form 11 card is the location of this found error. COR - Make the task used at the indicated phase in the network be a type 2 or 3 task or use a similar type task.
105	AT CONTROL XXX ONLY PART AND MEN RESOURCES PERMITTED ON AN I TASK AT NODE XXXXXX (CHECK)	F	EXP - Control XXX refers to the XXX row in the control table. Also the XXXth Form 11 card is the location of this found error. COR - Ensure that only men and a part are on a task used on an I mode branch in the network at location indicated.
106	AT CONTROL XXX MUST USE EXACTLY 1 PART PER I TASK AT NODE XXXXXX (CHECK)	F	EXP - Control XXX refers to the XXX row in the control table. Also the XXXth Form 11 card is the location of this found error. COR - Ensure that one and only one part (quantity = 1) are used on an I mode network branch in the network at location indicated.
107	AT CONTROL XXX ONE PART MUST BE CONSUMED AT NODE XXXXXX (CHECK)	F	EXP - Control XXX refers to the XXX row in the control table. Also the XXXth Form 11 card is the location of this found error. COR - If I mode is used on network branch, task used at this location must consume a part.
108	TASK NUMBERED XXXXXX IS USING A/C ILLEGALLY (CONSUME, GENERATE OR MORE THAN 1 A/C) CHCK 1	F	EXP - An A/C was found in the task resource requirements (TRR) field with a quantity greater than 1, or with consume not marked, or with other resources appearing in either the TRR or associated resource field. COR - With an A/C on Form 12 in TRR, do not use other resources anywhere, also do not use a quantity greater than 1, or use the A/C in the TRR unless it is a consume action.

109	A NODE NAME MAY BE USED ONLY ONCE PER AIR-CRAFT, GROUP XXX SKIPPED (22.INPTKG)	W	EXP - Trigger node specified in definition set XXX (three sets across page) had been previously specified for this aircraft, entire set skipped. COR - Define the proper trigger node name on Form 22, if skipped set is actually needed.
110	ATTEMPT TO REDE-FINE AUTHORIZED QUANTITY IN GROUP, XX, FIRST NON-ZERO VALUE USED (22.INPTRG)	W	EXP - Authorized quantity on Form 22 was previously defined with the name of the internal equipment. It is required only once, first quantity is used. COR - If quantity ignored was only a repeat of previous quantity, do nothing. Otherwise, check which quantity specified is correct and input first time internal equipment is defined.
111	AN INTERNAL EQUIPMENT NAME MISSING GROUP XXX, SKIPPED (22.INPTRG)	W	EXP - No internal equipment name was specified in the XXX set (three sets across page) on Form 22. COR - Define the internal equipment name on Form 22.
112	TRIGGER STATUS MISSING OR INVALID FOR GROUP XXX, + ASSUMED (22.INPTRG)	W	EXP - The XXX set of trigger statuses was undefined (3 sets across page) on Form 22. COR - Change missing status to either + or - on Form 22. If + is required, default will be +, and nothing is required.
113	SET TO SEARCH INVALID OR MISSING, 'A' ASSUMED FOR GROUP XXX (21.INPSP)	W	EXP - The aircraft set, cocked (C) or available (A) specification in Col. 12 or 13 on Form 21 was "blank". COR - Place proper aircraft set code (C = cocked; A = available) in the proper column. If default "A" is fine, do nothing.
114	AIRCRAFT CANNOT BE USED ON A SHIFT . . . CARD IGNORED (16.INPSHF)	F	EXP - The resource ID field (Cols. 07-12) on a Form 16 cannot be an aircraft. COR - Correct the Form 16 Resource ID or remove the card.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
115	NODE MUST HAVE BEEN DEFINED AS 'T' ON FORM 11. GROUP, XXX, SKIPPED (22.INPTRG)	W	EXP - Form 11s must be processed before Form 22s, or when node defined on Form 22. COR - Process Form 11s prior to Form 22s, or change selection mode to T where trigger node was used in Form 11s, or eliminate trigger node definition on Form 22.
116	INTERNAL EQUIPMENT NAME MAY APPEAR ONLY ONCE PER INTERNAL EQUIP. GROUP. IGNORED 2ND INSTANCE OF XXXXXX (23.INPIEL)	W	EXP - The same piece of internal equipment was used more than once in a particular Internal Equipment Grouping on Form 23. COR - Eliminate duplicate internal equipment from the grouping of internal equipment on Form 23.
117	THE FOLLOWING INTERNAL EQUIPMENT NAMES WERE DEFINED FOR AN AIRCRAFT BUT NEVER USED ON FORM 23. (CHCK1)	I	EXP - Internal Equipment defined on Form 22 were not specified within any Internal Equipment Group on Form 23. COR - Eliminate equipment definition from Form 22 or use on Form 23.
118	SKIP FOR SPARE INDICATOR NOT AN 'X' TREAT AS IF BLANK 921.INPSP)	W	EXP - The modification of the A/C search pattern (Form 21) for spare A/C assignment logic requires either a blank or an "X" be placed in the "SKIP IF SPARE FIELD". (Column 42 or 73) COR - If the specific search is to be used for spare A/C assignment the field must be blank. If the search is not to be used for spare A/C assignment the field must contain an "X".

119	NON-MAN RESOURCE SPECIFIED ON 12A ABOVE-ILLEGAL (12.INPTSK, CHECK)	F	EXP - Only man resources can be specified on a Form 12A as a Task Resource Requirement. COR - Remove the non-man resource from the 12A. It's assumed that all non-man resources were requested on the Form 12s.
120	FORM XX MUST PRECEED OR YY (22.INPTRG, 21.INPSP, 23.INPIEL)	F	EXP - Self-explanatory. COR - Insure Form XXs precede Form YYs in the input data.
121	PROCESSING OF ITEMS OTHER THAN A/C CANNOT HAVE CONFIGURATIONS (17.INPIET)	D	EXP - Only A/C can have configurations specified in Cols. 22-27 or 29-34 of a Form 17. COR - Remove extraneous info from Pre-sortie and Post-sortie external configuration fields.
122	AIRCRAFT NAME MISSING - MISSION IGNORED (17.INPIET)	F	EXP - A/C name must be specified in Col. 43-48 of the Form 17 - it was left blank. COR - Place appropriate A/C name on Form 17.
123	SEARCH PATTERN MAY APPLY ONLY TO ONE A/C TYPE XXXX IS PRIOR USE (17.INPIET)	W	EXP - Search pattern specified in Col. 36-41 on Form 17 was specified in preceding records with a different A/C (Col. 43-48). COR - Search pattern names must be unique by A/C. Use a different name.
124	EMPIRICAL DISTRIBUTION XX NOT USED BY TASK OR FAIL (CHCK1)	I	EXP - Empirical distribution was defined but not used. COR - Either remove distribution from data base or find what task or clock was to use it and correct that reference. Col. 36-41 on Form 13 or Col. 15-20 on Form 12.
125	NO KEYWORD ID SPECIFIED - EXOG PACKAGE SUPPRESSED. (20.INPUT9)	W	EXP - Keyword identifier for exog Form 20 file must be specified in Col. 9-14 on first record after the Form 20 reader record. COR - Insert any 6 character identifier or ensure that only one set of Form 20s are in data.
126	WARNING-ZERO VALUE FOR MIN 1 ASSUMED. (20.MREAD)	W	EXP - Min cannot be a zero on Form 20 Col. 34-35. COR - Insert proper minimum value for the mission if default of 1 is not suitable.

INPUT MODULE DIAGNOSTICS (Cont'd)
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
127	WARNING - MAX TOO SMALL - MIN VALUE USED (20.MREAD)	W	EXP - Mission max field cannot be less than min field. COR - Insert proper max value unless MAX = MIN. Also check for data fields being misaligned.
128	TYPE 5 TASK CANNOT USE RESOURCES, IGNORE COLUMNS (12.INPTSK)	D	EXP - The above type 5 task had data in Columns 37-63. Type 5, other is for delay type tasks only and can't have resources. COR - Remove any data from Cols 37-63 to eliminate this error message.
129	CONFIGURATION GROUP XX HAS BEEN DUPLICATED (SAME INTERNAL AND EXTERNAL CONFIGS AND SAME C OR A SET) (21.INPSP)	F	EXP - On the Form 21s a configuration group has been duplicated entirely. This error has been made fatal because this could affect simulation results drastically if a different rather than a duplicate configuration was meant. COR - If the configuration is truly a duplicate, eliminate it from the search pattern. Otherwise, correct it.
130	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
131	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
132	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
133	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED

134	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
135	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
136	T DISTRIBUTION FORBIDDEN IN TAC MODEL (20.MREAD)	W	EXP - With the TAC option on Form 20 operational data in Col. 73-80 is reserved for additional info. COR - Use a distribution other than triangular or if TAC option not desired eliminate the "T" in Col. 2 of the 2nd Form 20 record.
137	RESOURCE OF TASK DOES NOT HAVE REQ'D GENERAL SUBSTS - X IS IGNORED (14.INPTSK)	W	EXP - On the Form 12 or 12A, a resource has been marked for letting general substitution apply; i.e., an "X" has been entered in the associated Col. 43, 52, or 61. However, this resource has no general substitutes specified for it in the Form 13s. COR - To suppress the printing of this message, remove the X from the appropriate Col. 43, 52, or 61 of this Form 12 or 12A if this resource is not supposed to have any general substitutes. Otherwise, correct the Form 13s to allow general substitution for this resource.
138	ABOVE CARD HAS DEFINED A DUPLICATE GENERAL SUBSTITUTE - DUPLICATE IGNORED (13.INPRES)	W	EXP - On the above Form 13, the same resource has been named more than once as a general substitute. COR - Ensure that all general substitutes for this resource have been listed and then eliminate the duplicate general substitute.
139	ABOVE CARD IS AN OUT OF ORDER CONTINUATION CARD OR ATTEMPTED REDEFINITION - CARD IGNORED (HASH.INDEX)	F	EXP - Either the above Form 13 is a continuation card which didn't directly follow the Form 13(s) it was continuing, or it had the same resource ID (Cols. 5-10) as a previous Form 13 and had a resource type specified which implied attempted redefinition. COR - If this Form 13 was a continuation card, put it in its proper place behind the card(s) it is continuing. If this is an attempted redefinition, remove whichever Form 13 is not wanted.

INPUT MODULE DIAGNOSTICS
(Type W = Warning, I = Informational, F = Fatal, D = Data)

MSG NBR	MSG (ROUTINE)	TYPE	EXPLANATION/CORRECTIVE ACTION
140	****THE FOLLOW-TASKS HAVE MULTI-PLY DEFINED RE-SOURCES **** (12.SUBS.EDIT)	I	EXP - This message preceeds a list of resources which are involved in circular substitution on a Form 12 or 12A. These resources can substitute for another resource named on the same form; or they can be unnamed resources that can substitute for more than one resource named on the same form. COR - The danger in circular substitution is that the Main Module can only search for the same resource once within a single set of resources for a task. For example, assume that 2 CREWCHs are available, no GENTECs are available, and a CREWCH can substitute for a GENTEC. Then, if the only combination of resources requested on the Form 12s and 12As for a particular task was 1 CREWCH and 1 GENTEC, this task could not start. The Main Module couldn't pick up the 2nd CREWCH. So, ensure that all allowable combinations are specified in the Form 12s and 12As. In the above example, so long as there was a Form 12 or 12A that called for 2 CREWCHs and no GENTECs, there is really no problem.
141	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
142	ILLEGAL ASSO-CIATE RESOURCE - CARD DROPPED (12.INPTSK)	F	EXP - An "*" has been found in Column 29 of the above Form 12A and an associated resource is illegal on a Form 12A. COR - Remove the asterisk from Col. 29 and any name from Cols. 30-35 that is not a resource combination set name.
143	MSG UNUSED		EXP - MSG UNUSED COR - MSG UNUSED
144	TASK SUBSTITU-TION NUMBER BLANK - TREATED AS ZERO (12.INPTSK)	W	EXP - Col. 36 on the above Form 12A has been left blank, so the order of the Form 12As will default to the order of input. COR - To suppress printing of the message, number the 12As in a group in Col. 36 in sequential preference order.

145	NO RESOURCES LISTED FOR ALTERNATE TWO CARDS ABOVE (12.INPTSK)	W	EXP - On the Form 12A, there were no resources listed in Cols. 30-63. This Form 12A was dropped COR - Eliminate this empty Form 12A if unneeded, else enter the appropriate resources.
146	THE FOLLOWING RESOURCE COMBINATION SETS HAVE BEEN DEFINED WITH THE SAME RESOURCES (CHCK1)	I	EXP - In the Form 12As, the same set of resources has been defined more than once with different "Resource Combination Set" names in Cols. 30-35. COR - Check that the sets are meant to be the same. If not, correct the requirements, else do nothing or make the "Resource Combination Set" names the same.
147	REDEFINITIONS OF THE FOLLOWING RESOURCE COMBINATION SETS WERE ATTEMPTED AND FLAGGED BY MSG 56 (CHCK1)	I	EXP - In the Form 12As, the same "Resource Combination Set" name, Cols. 30-35, was used for different sets of resources. Only the first defined set is used for all occurrences of the same RCS name. COR - Change the "Resource Combination Set" name to a unique name for each unique set of resources. Correct any resource set that should have matched a previous resource set with the same RCS name. Of course, the idea of the RCS name is that you only need define the set of required resources once and can specify only the RCS name after the initial definition.
216	ATTEMPT TO CALL A RELEASED ROUTINE	F	EXP - On the CDC and ITEL (IBM) implementations of the input module, this message is generated rather than the messages 64, 70 or 73. It means that a particular form was found apart from the forms of the same type. COR - Determine if the misplaced record is valid and if so, place it with the rest of its data.

Appendix C

Main Module Diagnostic Messages

All user and programmer oriented messages described in this appendix have the same message numbers that are printed on the Main Module runs, for ease of reference to these descriptions. However, there are some internal programmer messages generally used for implementation checkouts that will not have message numbers. Users will see these messages only if he has, (1) turned on special programmer debug switches (see table 7-1,, or (2) some data or program problem has occurred. In either of these cases, the AFMSMET programming staff should be contacted.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES
(TYPE: F=FATAL, W=WARNING)

Notes: 1. Several of the following messages indicate the corrective action to be - contact programmer. These messages were installed during model development and may never occur due to the completeness of past model testing. The messages, however were left in the main model to aid programmer resolution of any future severe problems.

2. Four arguments are provided with each message. All those not indicated under the Explanation field will be null (=0.0).

3. One message is unnumbered - "THATS ALL FOR NOW" - this message indicates that no exogenous file was assigned.

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
501	NESTING OF CALL TASKS GT MAX AL LOWED. NO PARALLEL IS (CONTR)	W		Too many tasks are in parallel emanating from a single node. Not all will be processed. MAX = 20.
-			1.	Depth of PUSH DOWN STACK
				Reduce the number of parallel tasks or request main model programmer to increase the STACK.COUNT test parameter in subroutine CONTR. Rerun main simulation.
502	TASK ID NOT IN CTK.NOCL LIST (DECREMENT.CLOCKS)	W		Control table entry XXXXXX should contain a task that decrements a clock, but does not. Decrementing ignored.
			1.	Current position of KTRN in control table
			2.	Task ID
				This is a programmer debug error message which aids in isolating errors between the Form 11 and Form 14. Contact programmer.
503	PARALLEL CALLS. PARENT OF KTRN NOT EQUAL TO NEXT KTRN (CONTR)	W		This is a parallel calls implementation debug message. It will print when processing tasks in a push down stack and a wrong parent TRN is being addressed.
			1.	All arguments will be null.
				Use the print "DISPLAY" of the designated A/C. Contact programmer.

504	INVALID RESOURCE ID FOR A/C (ISHIFT.START)	F		A/C resource on a shift yet ID doesn't agree.
			1.	ID number for A/C
				Problems in data storage - contact programmer.
505	NEGATIVE ACRID. ACFT FOR A/C (ISHIFT.START)	F		A/C on a shift but user had used a CANCM change card.
			1.	ID number for A/C
				Either remove A/C from Form 16 or don't use CANCM change card.
506	REQUIRED RES NOT FOUND IN RESR.SET, REQUESTS.SECTION (ENDTRN)	F		This debug message indicates serious program logic and/or pointer problems caused by a coding change.
			1.	ID number of resource.
				Contact programmer. Check all new coding changes thoroughly. Back up to version prior to the new change and test with the same input data. Also, changes to the input model could possibly cause this message.
507	ENTERING RESOURCE NOT IN LIST OF VALID NAMES...NOT PROC (FRAG)	W		An A/C or non-aircraft was requested on the Form 20 that was eitner not defined on the Form 13 or not flagged as a valid entry resource, or was removed from the list of A/C names by a "CANCM" change card.
			1.	All arguments will be null.
				Define A/C on the Form 13, or, flag resource as a valid network entry resource in Col 11 on form 13, remove the 'CANCM' change card, or, if CANCM change was desired, do nothing.
508	MISSION/ACTIVITY NAME UNDEFINED.. NOT PROC	W		A mission was requested on the Form 20 that was not defined on the Form 17.
			1.	All arguments will be null.
				Define the mission on the Form 17 or change the MSN name on the Form 20 to one that was defined.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES (Cont'd)
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
509	RESR.SET DOES NOT HAVE REQ'D RES ID (ISHIFT.START)	F		The 'SCAT' column heading of a part TRN was defined as "0".
			1.	Resource ID
				Contact programmer. This problem should be resolved in the input model which insures the smallest value of 'SCAT' is 1.
510	A/C RELEASED AND NOT ASSIGNED BY SEARCH (JOB.END)	W		An aircraft finished its post-sortie processing and was released. The aircraft was not reassigned to an outstanding unfilled mission or activity, but was placed in the appropriate ready que determined by its configuration. If there were no outstanding unfilled missions or activities when the aircraft was released then this message would not have been printed. The first ten (10) times this message is printed a mission status report is immediately printed to aid in analysis of the message and help determine if the Search Patterns (Form 21s) were performing as expected.
			1.	XX.YY where the sign indicates status (positive - available and negative - cocked), XX is external configuration #, YY is the internal configuration index.
			2.	Number of outstanding unfilled mission demands.
			3.	Number of outstanding unfilled activity demands.
				A user may have established mission or activity requirements that do not search the configuration of the released A/C, i.e., this may well be valid. Verify by checking the forms 21 and 17 and the 3 message arguments.
			4.	Aircraft type.
511	RESR.SET DOES NOT HAVE REQ'D RES ID. (ISHIFT.START)	F		Indicates serious program and/or pointer logic.
			1.	Resource ID.
				Contact programmer.

512	FPAR LESS THAN CURRENT TIME...CARD IGNORED (SECIN).	W	Change card invalid at time greater than zero. Do not use this change card in either a schedule SECIN or on a restart.
513	MSG UNUSED		MSG UNUSED
514	SECIN...INVALID CHANGE CARD FOUND ABOVE	F	One or more of the above change cards are invalid. Review the set of change cards and correct those that are followed by a fatal message.
515	A/C NOT FOUND IN MSNQ.SET (SEARCH)	F	The MSN requested by the calling routine is not a valid MSN. Contact programmer to check the code in the calling routine.
516	NO A/C IN RQST.SET MATCHES MISSION/ ACTIVITY ID (SEARCH)	W	MSN or activity XXX has no corresponding unsatisfied A/C requirement in request set. 1. Aircraft type 2. Mission/activity ID Contact programmer to check the code in the calling routine.
517	A/C NAME NOT IN LIST OF VALID NAMES ...CARD IGNORED. (SECIN)	W	A/C elimination change card 'CANCM' requested an A/C not defined on Form 14, or previous CANCM card had been used. Use the correct A/C name in the 'CANCM' change card.
518	BAD SHIFT TABLE INDEX...CORRECT THE FPAR...CARD IGNORED (SECIN)	W	Shift change request 'SAUTH' specified an illegal shift or a resource not on a shift. Check dictionary of resources requested and Form 16 input.
519	IPAR LE O...CARD IGNORED. (SECIN)	W	Shift change request 'SAUTH' specified an illegal resource number. Check dictionary of resources for the proper number.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES (Cont'd)
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
520	IPAR OUT OF RANGE... CARD IGNORED (SECIN)	W		IPAR field invalid Check change card parameter definitions and correct.
521	CHANGE CARD NAME INVALID...CARD IGNORED (SECIN)	F		Columns 1-6 of the change card contain an illegal name. Change cards must only be those authorized and documented.
522	FPAR LESS THAN ONE. NUMBER OF DAYS MODEL WILL RUN IS (SECIN)	W	1.	The 'STOP' card has a value less than the dump interval. No of days model will run By default, only one dump interval will be run. If this is not satisfactory, change the time on the 'STOP' card.
523	ERROR IN BACK-ORDER LOGIC (START)	F		This is a debug message indicating serious program logic and/or pointer problems caused by a coding change. Contact programmer. Check any new coding changes thoroughly. Insure that a valid initialization was produced by the input model if coding changes were made there. Back up to a previous version if necessary.
524 or 525	LID MAXIMUM SIZE EXCEEDED (START)	F		The number of resources required by a particular task, and used substitutes, exceeds 35. The task will be incorrectly processed.
			1.	Time.V Insure the Form 12 task resources required are reasonable, or, contact programmer to redimension 'LID', 'LIQ', and 'LDEF' in 'START'.

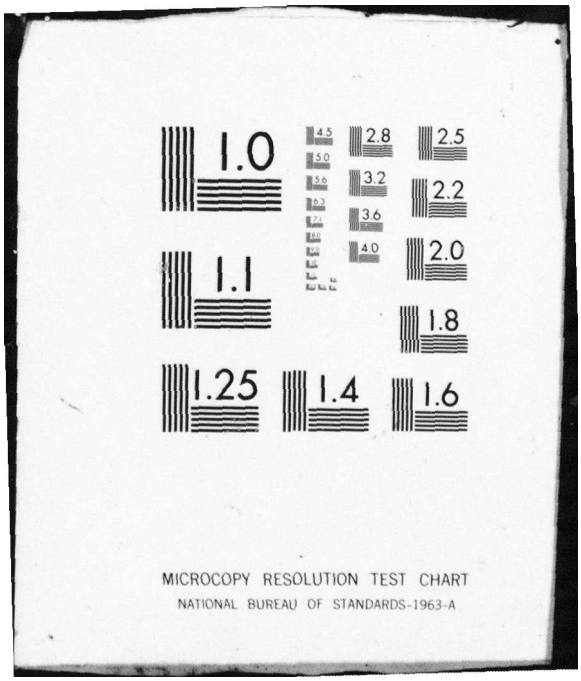
526	RESR.SET DOES NOT HAVE REQ RES...ID AND JOB.END ARE (START)	F	This debug message indicates serious program logic and/or pointer problems caused by a coding change. 1. Original Resource ID 2. Pointer to job end in due in thread 3. Time.V Contact programmer to check all new coding changes thoroughly. Back up to the version prior to the new change and test with the same input data. Also, changes to the input model could possibly cause this message.
527	LBJ MAXIMUM SIZE EXCEEDED (START)	F	The list of tasks to be expedited exceeds 20. Those above that will not be considered. System is bogged down indicating other data problems may exist, contact programmer to increase the dimensions of LBJ.
528	JOB.HAS BEEN PRE-EMPTED 500 TIMES (START)	W	This debug message indicates that a low priority job has been preempted too often. Contact programmer to assist in data base correction.
529	PROBLEM IN START. JOB.END AND NET ARE (START)	F	This message indicates serious pointer problems. 1. JOB.END ID 2. ID of net associated with TRN Contact programmer to check any new coding changes to routine 'START'.
530	MSG UNUSED		
531	A/C IN LIBBO AT THE SORTIE TASK (CONTR)	W	A task is being processed that would be in parallel to the sortie task. Sortie delayed until task is complete. See msg 533. 1. Temporary resource number Check networks to insure this condition does not happen. It could be only a dummy task doing this and would not affect the results.

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SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES (Cont'd)
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
532	CALL PARAMETER IX IS (SEARCH)	F		The quantityneeded (IY) passed to 'SEARCH' is greater than 20.
			1.	IX Value
				Contact programmer to check the code in the calling routine.
533	A/C OUT OF LIMBO AT THE SORTIE TASK (CONTR)	W		Upon completion of task in parallel with the sortie, sortie is permitted to continue.
			1.	Temporary Resource Number (KTRN)
				See msg 531.
534	IPAR OUT OF RANGE... CARD IGNORED. (SECIN)	W		The subscript (IPAR) of the change card is not 1, 2 or 3.
			1.	Value of IPAR (Certain calls will not provide this value.)
				Correct the IPAR field.
535	INVALID SWITCH NUMBER...CARD IGNORED (SECIN)	W		The switch to be referenced must be 1-15.
				Correct the IPAR field of the change.
536	STATUS REPORT PREVIOUSLY REQUESTED...CARD IGNORED (SECIN)	W		This status report cannot be requested for a restart if it had not been requested for the original run (TIME = 0).
				Remove this change card from the restart input change card file.
537	ILLEGAL CHANGE CARD ON A RESTART ...CARD IGNORED. (SECIN)	W		The field to be changed cannot be changed after time ZERO, i.e. not on a restart or scheduled SECIN.
				Remove this change card from the restart or scheduled SECIN change card file.

538	A CHANGE OF CYCLE OR REPORT COL MAY CAUSE BAD TOTALS (SECIN)	W

Changing the cycle of the report may cause the totals to be incorrect until all fields containing totals have been reset to zero in preparation for another cycle.

Beware of possible invalid totals if this change card is used.

539	BAD FPAR VALUE... CARD IGNORED (SECIN)	W

Value in FPAR field inconsistent with expected information.

Validate change card with user documentation and correct entry.

540	MSG UNUSED	

541	BAD SUBSCRIPT VALUES COMPUTED FROM DATA...CARD IGNORED (SECIN)	W

Change card IPAR parameter caused a subscripting error.

Check entire change card to insure all fields are correct and resubmit.

542	MISSION PROC...REQUESTED WITH INVALID DATA...IGNORED (FRAG)	W

Mission being requested on exog file invalid

1. Type of resource
2. Mission duration
3. Network control table entry point for specified mission/activity (negative for missions)

Check basic Form 20 data to insure that mission has a valid sortie duration.

543	ID NOT IN RESR.SET (JOB.END)	F

This indicates serious coding or pointer problems.

1. ID of backordered JOB.END
2. Index of control table.

Contact programmer for problem resolution.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
544	K-SELECTION MODE ATTEMPT WITH NON A/C RESOURCE (CONTR)	W		A non-aircraft resource is being processed thru either a J or K selection mode.
			1.	Selection mode J=8 K=9
			2.	Index of control table.
				J and K selection modes are only valid in an aircraft network. Verify network at control table index (argument 2).
545	SORTIE TASK REACHED BY NON A/C RESOURCE (CONTR)	F		A non A/C resource reached a sortie task - invalid or an A/C in post sortie processing reached a sortie task.
				Verify networks to insure that the sortie is not in a network section. It must be in main line network and cannot be processed by a non A/C resource. Also, check any air abort network branch returns to make sure that an AC can't process a second sortie task.
546	A/C ACTIVITY PROCESSING FOUND SORTIE TASK (CONTR)	F		An activity exogenous request processed until it reached a sortie task. - invalid.
				Verify activity networks and correct.
547	MSNQ.SET IS EMPTY (MSN.START)	F		This indicates serious coding or pointer problems.
				Contact programmer for correction.
548	NO BACKORDERED AIRCRAFT (ENDTRN)	F		This indicates serious coding or pointer problems.
			1.	ID of TRNA
				Contact programmer for resolution.
549	ID NOT FOUND IN RESR.SET (START)	F		This indicates serious coding or pointer problems.
				Contact programmer for resolution.

550	NTKNT.NET IS ZERO (DSTRN)	F		This indicates serious coding or pointer problems.
			1.	ID of TRNA, TRND or TRNS
			2.	ID of the controlling NET
				Contact programmer for resolution.
551	JJK SHOULD NOT BE NEGATIVE (DSTRN)	W		This indicates that the resource ID was negative when it entered this routines.
			1.	Resource ID
				Contact programmer for resolution.
552	ID NOT FOUND IN RESR.SET (FILE)	F		This indicates serious coding or pointer problems.
				Contact programmer for resolution.
553	NO AIRCRAFT WITH RES ID (CONTR)	W		This indicates serious coding or pointer problems.
			1.	Resource ID
				Contact programmer for resolution.
554	ID NOT FOUND IN RESR.SET (REMOVE)	F		This indicates serious coding or pointer problems.
			1.	Resource ID
				Contact programmer for resolution.
555	ID NOT FOUND IN RESR.SET (REMOVE)	F		This indicates serious coding or pointer problems.
			1.	Resource ID
				Contact programmer for resolution.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
556	NJOB3.TRN IS ZERO (PULL)	W		This indicates serious coding or pointer pointer problems. Contact programmer for resolution.
			1.	JOB.END ID
			2.	TRNA ID
557	CALC OF O VAR CHG'D TO 1; OR, MEAN NOT CHG'D TO Ø (SECIN)	W		On the change card printed prior to this message either the FPAR or FPAR2 field resulted in a mean or Variance of zero. Check Change card parameters and reinput. Read all referenced footnotes in the Change Card parameter requirements table.
558	BAD FPAR2 VALUE... CARD IGNORED (SECIN)	W		Value in FPAR2 field inconsistent with expected information. Validate change card against user documentation and correct entry.
559	AIRCRAFT NAME TO BE IGNORED IN FUTURE. RES. ID IS (SECIN)	W		CANCM change card used to cause non use of Exog requests for specified A/C.
			1.	Index of ACRID.ACFT No corrective action necessary except to validate that this is the action desired.
560	MISSION REQUEST AND A/C NAME CONFLICT WITH INPUT DATA (FRAG)	W		Aircraft specified for a mission was not the same as on the Form 17 for that mission. Mission will not be processed. This message can also occur if an activity's Form 17 did not have "AC" specified in the report column. Assure Form 20 request associates the proper A/C with the missions as defined on Form 17. Rerun EXOG.

561	ERROR ON A/C CONSUME (JOB.END)	F		Indicates serious coding problems.
			1.	TIME.V
				Contact programmer for resolution.
562	ILLEGAL LOCATION OF CONDEMNED TASK (START)	F		A branch in the network having a condemned type task on it had been reached prior to processing either a first base or first depot task.
			1.	TIME.V
				Check networks processing condemned type tasks and correct network.
563	INVALID ALPHA NAME ...CARD IGNORED	W	0	An invalid mission name was found IAPAR field (Cols 26-31) on either a PRBATT, PRBRAM or PRBABT change card.
				Verify that mission specified was a valid mission. Field must be left justified.
564	CHANGE CARD NOT ALLOWED...TAC MODS INOPERABLE (SECIN)	W	0	An ALTCOL or WCXCOL change card cannot be used until the TACMOD change card is used.
				Insure TACMOD card precedes the ALTCOL and WCXCOL cards.
565	AC FLAGGED 400 ATTEMPTED RECON-FIGURATION (SEARCH)	W		An aircraft that was a cocked A/C was selected and sent to a reconfiguration entry mode.
			1.	NETWORK ENTRY POINT FOR RECONFIGURATION
			2.	NETWORK ENTRY POINT
			3.	FOUND.AC TRNA ID
			4.	SEARCH PARAMETER IX (See Progmr Documentation 3.4.57.2)
				Check the search patterns to insure that classes established as strictly alert classes are not searched. This would happen when the post sortie (actually end of network) class on an activity (used to process alert A/C) is searched by other mission search patterns.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES (Cont'd)
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
566	SAUTH CARD NAMES RESOURCE NOT ON A SHIFT-IGNORED (SECIN)	W		Resource specified on the SAUTH Change Card is not on a shift. Validate affected Change Card with Form 16 input data and Resource Dictionary - Resubmit.
567	MSG UNUSED			
568	MSG UNUSED			
569	NON-AIRCRAFT FOUND A TRIGGER EVENT (CONTR)	F		A non-aircraft resource was found processing a trigger node. Thoroughly checkout the network.
570	INVALID T-SELECTION MODE (CONTR)	F		Indicates serious coding or pointer problems. Contact programmer for resolution.
571 or 572	BAD EQUIPINDEX IN TMATRIX (CONTR)	F		Indicates serious coding or pointer problems.
			1.	Aircraft type
			2.	Control table index
			3.	Trigger number
			4.	Trigger value
				Contact programmer for resolution.

573	BAD ELIST REFERENCE (SEARCH)	F		Indicates serious coding or pointer problems.
			1.	Internal equipment position in group
			2.	Internal Equipment Group
			3.	Position in search sequence
			4.	Mission type
				Contact programmer for resolution.
574	MSG UNUSED			
575	ILLEGAL RECONFIGURATION (SEARCH)	F		Indicates serious coding or pointer problems.
				Contact programmer for resolution.
576	LIFTMAX.... RAISING MAXFLY FROM 1 TO 2	W		This indicates that 20 percent more of the assigned aircraft are being generated during simulation. The maximum number of A/C that can be assigned is automatically changed.
			1.	Number of A/C previously authorized plus 20 percent.
			2.	Number of A/C now authorized. Argument 1 plus 20 percent.
				Verify that the number of A/C generated is as expected. If not then change networks to decrease the number of generated A/C.
577	TOO MANY MEN REQUIRED FOR CANNIBALIZATION (EXCEPT)	F		This indicates serious coding or pointer errors.
			1.	TIME.V
				Contact programmer for resolution.

SIMULATION MAIN MODULE DIAGNOSTIC MESSAGES (Cont'd)
(TYPE: F=FATAL, W=WARNING)

MSG NBR	MSG (ROUTINE)	TYPE	ARG	EXPLANATION/ARGUMENT DESCRIPTIONS/CORRECTIVE ACTION
578	START DID NOT SCHEDULE A JOB TO DO CANNIB (CANNIB)	F		This indicates serious coding or pointer errors.
			1.	TIME.V
				Contact programmer for resolution.
579	AIRCRAFT TRACKING REQUESTS OVERLAP (SECIN OR ACTRAK)	W		Change Card TRAKAC has FPAR2 field greater than FPAR field or when using two or more TRAKAC cards there is an overlap in the time periods specified.
			1.	Time of arrival of the TRAKAC card it overlaps with.
				Make appropriate TRAKAC Change Card/s corrections.
580	CONTR...NO CONSUME FOUND ON I TASK	F		Extension of Input Module Msg 97. Should not occur under normal processing.
			1.	Task Id
				Contact programmer for resolution.
581	CONTR...NON A/C FOUND ON AN I TASK	F		A non-aircraft resource is processing through the network which contains an I mode task. Off-equipment cannibalization is illegal.
			1.	Resource Id that is processing through network.
			2.	Task Id
			3.	Control Table Index
				Ensure that the I mode task indicated is defined in the network section processed only be an aircraft.
582 Thru 591	MSG UNUSED			

592	SECIN...IPAR2 VALUE NOT IN LEGAL RANGE	W	The above change card has an IPAR2 value which is greater than or less than the acceptable values. Refer to Change Card Chapter for the acceptable values.
593 Thru 601	MSG UNUSED		
602	SECIN...SELECTION MODE DOES NOT MATCH CONTROL TABLE	F	In the above change card the selection mode does not match the selection mode of the task whose control table index is specified in the IPAR field. Ensure the change card can be used with the indicated task.
603	SUMCHECK...E PROBABILITIES DO NOT SUM TO 1.0	F	The IPAR2 fields of the above EPROB change cards that refer to parallel task do not sum to 100. A 100 percent value in the IPAR2 field is equivalent to a probability of 1.0. Ensure the probabilities of all the associated parallel E tasks sum to 1.0 after the EPROB changes are implemented.
604	SECIN...FPAR MUST BE LESS THAN FPAR2 ...CARD IGNORED	W	On the above change card a time interval is specified in which the FPAR is the start time and the FPAR2 is the stop time. Ensure FPAR value is less than the FPAR2 value.
605	SECIN...OVER-LAPPING HITMAX PERIODS...CARD IGNORED	W	The above HITMAT card specifies a time period which overlaps with the time period of a previously mentioned HITMAT card. Ensure the time periods of the HITMAT cards do not overlap.
606	SECIN...INVALID CONTROL TABLE INDEX...CARD IGNORED	W	This indicates that the control table index specified on the above change card is not a valid choice. Check the Control Table produced from the Input Module for the proper index.

APPENDIX D

POST PROCESSOR DIAGNOSTICS

The post processor diagnostics currently are not sequentially numbered and listing them in a format such as in Appendix B and C is currently not feasible. However, the messages that do print are generally self-explanatory. Therefore, this appendix will be provided at a later date, probably with the first update of this publication.

APPENDIX E

MAIN MODEL CORE REQUIREMENTS FORMULA (HONEYWELL)

The main model memory approximation formula uses the Input Data Summary at end of Input Run (printed prior to the dictionaries), as follows:

Statistic	Value	Multiplier	Core Reqd
# of Resources		8	
# of Tasks Names		3	
# of Nodes (ignore)		Ø	
Control Table Entries		3	
Failure Clocks		3	
Mission Entry Points		4	
Resources Entering Network		12	
NCRS (*NSRPT)		1	
Search Patterns (NSRPT)		Ø	
Next Higher Failures		2	
Task Resource Requirements		1	
NOCL		2	
Plus Data from Form 16			
# of Shifts * # Resources on Shift		3	
Plus Data from Form 10			
# Operations Headings		14	
# A/C Headings		24	
# Personnel Headings		20	
# Part Headings		24	
# AGE Headings		22	
Plus Aircraft Costs			
# of Aircraft Authorized (UE), all types		13	
Above Core Requirements (subtotal)			
+ Miscellaneous Data			1,000
+ Program			71,000
+ Dynamic Memory Required 5K - unconstrained, 4-15 K-constrained, highly constrained-25K			
Total Required			

LCOM II MAIN MODEL CORE REQUIREMENTS FORMULA (CDC)

The main model memory approximation formula uses the Input Data Summary at end of Input Run (printed prior to the dictionaries), as follows:

Statistic	Value	Multiplier	Core Reqd (Decimal)
# of Resources		6.2	
# of Tasks Names		2	
# of Nodes (ignore)		Ø	
Control Table Entries		2.5	
Failure Clocks		2.6	
Mission Entry Points		2.5	
Resources Entering Network		10	
NCRS (*NSRPT)		1	
Search Patterns (NSRPT)		Ø	
Next Higher Failures		.3	
Task Resource Requirements		1	
NOCL		1	
Plus Data from Form 16			
# of Shifts * # Resources on Shift		3	
Plus Data from Form 10			
# Operations Headings		14	
# A/C Headings		24	
# Personnel Headings		20	
# Part Headings		24	
# AGE Headings		22	
Plus Aircraft Costs			
# of Aircraft Authorized (UE), all types		9	
Above Core Requirements (subtotal)			
+ Miscellaneous Data			1,000
+ Program			54,000
+ Dynamic Memory Required 5K - unconstrained, 5-15 K-constrained, highly constrained-25K			
Total Required			Convert above no. to Octal

APPENDIX F SELECTION MODE FUNCTIONAL CHART

The Selection Modes available to the LCOM II user are the tools by which he is able to describe the process or flow of maintenance tasks to be simulated. His "description" is then input into the LCOM Input Module which edits and compresses the information into a format which may be efficiently processed by the LCOM Main Module. The table below describes each of the fourteen available Selection Modes, their parameters, uses, and limitations. All Selection Modes are fully described in Chapter IV.

SELECTION MODE	SYMBOL	PARAMETERS	FUNCTION	LIMITATIONS/CAUTIONS/REMARKS
1. Non-mutually exclusive task selection.	A	Independent probabilities of task selection.	To model the case where one or more tasks/paths may emanate from one event or node, where any, all, or none of the paths may be taken.	Primarily pertains to the "independence" of failures and the fact that possibly none of the pathes will be selected. Do not mix separate sets of As, Es, or Gs from the same node.
2. Constrained task.	B	N/A	To constrain or hold up the processing of other parallel tasks in the same network string.	Not recommended for use since a C (Call) selection mode can accomplish the same result and is not as dangerous.
3. Call	C	The network node to be "called" is placed in the task name field on the Form 11.	Similar to a subroutine call in computer programming. Processing is transferred to the called network section. All tasks in the section must be completed prior to the next network node.	Most network constraints should be handled via this selection mode (see #2 above).
4. DO	D	N/A	Once a D (DO) selection mode is reached in the task network, the task is always executed.	
5. Mutually exclusive task selection.	E	Probabilities of task selection (must add to 1.0).	To model the case where one of two or more mutually exclusive tasks/paths is to be selected.	Do not mix separate sets of As, Es, and Gs from the same node. Probabilities must sum to 1.00.
6. Failure	F	a. Failure "Clocks" whose value may be a constant or any of the distributions referred to in Chapter III. These clocks may be decremented (counted down) by flight hours, sorties, or a pure number.	a. To allow the "opening" or processing of selected network paths by opening a "failures gate" which allows the network tasks associated with the failed part to be processed.	a. Failure clocks will not string backwards through a C (Call) selection mode task (#3 above).
		b. The model also allows a special "dummy" clock to be used (field left blank). Dummy clocks are used to string/link together all common F selections of the task networks back to a common node.	b. The function of dummy clocks is to allow entry into a large set of task networks at a few nodes. This convenience simplifies entry into the task networks because the failure of a real clock will automatically string backwards to the common node by opening the gates controlled by the dummy clocks.	b. Attempting to string two F selection mode tasks back from one common node will not work since the input model will "over-write" the first task when attempting to string the second task. However, use of the same Failure Clock in several places in the network is permitted.
7. "Get" at least one non-mutually exclusive task.	G	Dependent probabilities of task selection. See A selection mode above.	To model the case where one or more tasks/paths may emanate from one event or node, and one or more must be taken.	Designed to be used in conjunction with E selection mode probabilities for shop entry. However, it costs more in computer run time than the A selection mode. See Chapter IV. Do not mix separate sets of A, E, or G from the same node.

SELECTION MODE	SYMBOL	PARAMETERS	FUNCTION	LIMITATIONS/CAUTIONS/REMARKS
8 Halt	H	Halt Clocks. No "dummy" clocks are allowed. See F selection mode above.	Reverse of F above, i.e., ability to close or shut off a task or path.	Do not place an H task directly between a mission entry point and a sortie task, i.e., must be able to reach sortie task. Insure a one to one relationship between the H selection mode task and its clock decrement.
9. Ignore	I	N/A	To enhance the realism of the LCOM cannibalization process by showing the amount of time required to cannibalize a part. Times of all tasks coded I are ignored except when the part associated with the particular I selection mode task is cannibalized.	The I task must be the task which makes the supply demand, i.e., one that would be back-ordered if no part was available, i.e., a NORS condition.
10. Jump	J	N/A	To allow certain tasks to be accomplished only once within a user specified period. Controlled by the aircraft timing switch (KTIMSW). If this switch is on, all tasks with a J selection mode are jumped (processing is skipped). If KTIMSW is off J and K tasks default to D (DO) tasks.	The J task turns the aircraft timing switch "partially on." It is turned "fully on" by subsequently reaching a K (Kill) task, or reaching the end of the network.
11. Kill	K	N/A	Turns on the aircraft timing switch fully on immediately so that all down stream J or K selection mode tasks are jumped (processing skipped).	Insure that any K selection mode task is networked after all required J selection mode tasks.
12. Resource availability.	R	N/A	The R selection mode permits the user to place tasks on parallel network branches originating from a common node, and based upon resource availability, only have one task process.	Do not mix R selection modes with other selection modes emanating from a single node. Also do not place in pre-sortie networks.
13. Sortie	S	N/A	To allow for time constrained tasks associated with a scenario or flying schedule to be controlled and executed. The sortie take-off time and length are taken from the Form 20s.	Sortie tasks cannot require, consume or generate resources. Tasks should not be placed in the network in parallel with the sortie task.
14. Trigger selection mode.	T	N/A	Processes the internal configuration triggering of the increasing and decreasing of quantities of internal equipment.	Treated as a DO task. See Configuration Management write-up for details.
15. Unscheduled KTIMSW Reset	U	N/A	Deactivates (unsets and unschedules) a fully on Aircraft Timing Switch, i.e., the switch gets reset and the automatic resetting of the switch is unscheduled.	Only use the U selection mode on tasks that are normally do (D mode) tasks. U defaults to a D regardless of the U mode action with the switch.

Appendix G

Performance Summary Report Statistics

Calculation Methodology

This Appendix provides an understanding of the method and timing of statistic calculations for the Performance Summary Report (PSR). The LCOM I (OLD) statistic numbers are printed on the PSR report and therefore provide a ready reference.

A. OPERATIONS STATISTICS

OLD NO. 1 NUMBER OF MISSIONS REQUESTED

A value of one is added to this statistic upon each entry into the mission starting event where no mission cancellation has been scheduled. If one has been scheduled, the statistic is not calculated. It is possible that the mission is requested in one report period and flown in another, particularly if the PSR is printed during the time period when sortie scheduling is taking place.

OLD NO. 2 NUMBER ACCOMPLISHED

A value of one is added to this statistic by the mission starting event after it has been determined that the minimum number of aircraft required to fly the mission is ready. It is possible in a time period to have more missions accomplished than requested, particularly if the PSR is printed during the time period when sortie scheduling is taking place.

OLD NO. 3 PERCENT ACCOMPLISHED

This statistic is the ratio of the number of missions accomplished to the number of missions requested. If the number requested is zero, no statistic is calculated. The ratio is multiplied by 100 to display a percentage value. The statistic is calculated at the time of the PSR output.

OLD NO. 6 NUMBER OF SORTIES REQUESTED

The maximum number of sorties required for a mission is added to this statistic upon each entry into the mission starting event where no mission cancellation has been scheduled. (Spares are not included.) If a mission cancellation has been scheduled, the statistic is not calculated. It is possible that the number of sorties requested is calculated in one report period and the sorties flown in another, particularly if the PSR is printed during the time period when sortie scheduling is taking place.

OLD NO. 7 NUMBER ACCOMPLISHED

In the mission starting event, after it has been determined that a mission is going, a value of one is added to the statistic for each aircraft that is to fly the mission. Spares are not counted. It is possible in a time period to have more sorties accomplished than requested, particularly if the PSR is printed during the time period when sortie scheduling is taking place.

OLD NO. 8 PERCENT ACCOMPLISHED

The statistic is the ratio of the number of sorties accomplished to the number of sorties requested. If the number of missions requested is zero (implying no sorties were requested) no statistic is calculated. The ratio is multiplied by 100 to display a percentage value. The statistic is calculated at the time of the PSR output.

T1 NUMBER OF WEATHER CANCELS

At the time of the weather cancel, the maximum number of aircraft requested is added to the statistic. Mission tapering may or may not affect the statistic depending upon user data.

T2 NUMBER OF WEATHER DELAYS

At the time of the weather delay the maximum number of aircraft requested is added to the statistic. Mission tapering may or may not affect the statistic depending upon user data.

T3 NUMBER OF ALERT REPLENISHMENT

At the time of the alert replenishment, the maximum number of aircraft requested is added to the statistic depending upon user data.

T4 NUMBER OF ATTRITIONS

When the aircraft actually "flies", and the aircraft is to attrit, a value of 1 is added to the statistic.

T5 NUMBER OF RAM REPAIRS

When the aircraft actually "flies", and the aircraft is to go into repair, a value of 1 is added to the statistic.

T6 NUMBER OF AIR ABORTS (TOTAL)

When the aircraft actually "flies", and the aircraft is to abort, a value of 1 is added to the statistic.

A1 AVG. AC POST SORTIE TIME (HRS)

For each aircraft that reaches end of network, the elapsed time between the end of its sortie tasks and the end of its post-sortie processing is added to a total. This total is divided by statistic A2 to produce statistic A1.

A2 NO. OF POST-SORTIES COMPLETED

A value of 1 is added to this statistic whenever an aircraft completes its post-sortie network.

B. AIRCRAFT STATISTICS

OLD NO. 13 NUMBER OF AIRCRAFT AUTH. (EOP)

The current authorized level of aircraft at the performance summary report time is added to the statistic. It is an end of period statistic.

OLD NO. 14 NUMBER OF AIRCRAFT DAYS AVAIL

The statistic is calculated before each change in the authorized level of aircraft. The product of the current authorized level and the length of time at that level is added to the statistic. There are ten possible places this can occur.

- At the beginning of the simulation the statistic is updated to initialize collection of the statistic.
- The statistic is updated prior to disposing of an aircraft satisfying a backordered "consume."
- The statistic is updated prior to adding a "generated" aircraft to the system.
- The statistic is updated prior to disposing of an aircraft satisfying an immediate "consume."
- The statistic is updated prior to disposing of an aircraft to be removed from the system by aircraft attrition.
- The statistic is updated prior to removing an aircraft from the system because of RAM repair.
- At PSR time, if the aircraft is on a shift, the statistic is updated prior to reporting.
- At PSR time, if the aircraft is not on a shift, the statistic is updated prior to reporting.
- Prior to shift change, the statistic is updated if the aircraft is on a shift.
- When an aircraft returns from RAM repair, the statistic is updated.

OLD NO. 15 PCT SORTIES

This statistic is calculated in three places.

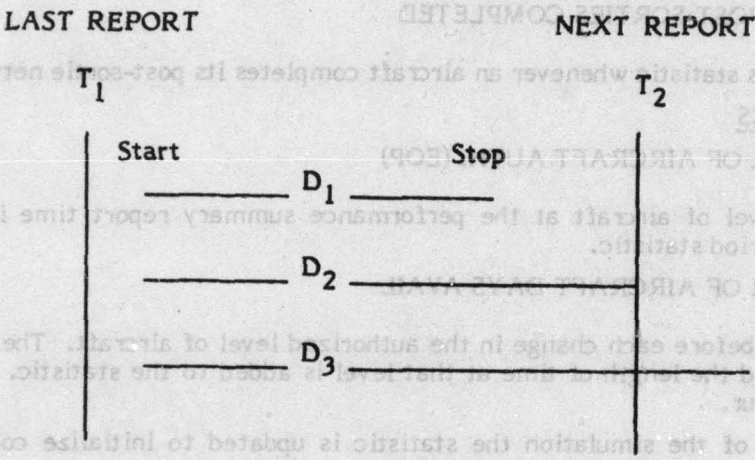
When a sortie task is started, the increment of time until the next level one PSR is determined. If this increment of time is greater than or equal to the length of the sortie, the sortie duration (in days) is added to the statistic. If the sortie will extend into the next PSR reporting period, the increment of time until the next level one PSR is added to the statistic.

When a sortie task is completed, the length of time that the sortie was flown in the current PSR report period is calculated. Also, the elapsed time since the last report is determined. If the time since the last report is greater than the time flown, no data is collected since the time has already been added (see above - sortie started and completed in same report period). If the time since the last PSR is equal to the time flown in this PSR report period, the days are added to the statistic.

At PSR time, the statistic value is converted into hours and is stored for later use. The stored flying days are not changed, however.

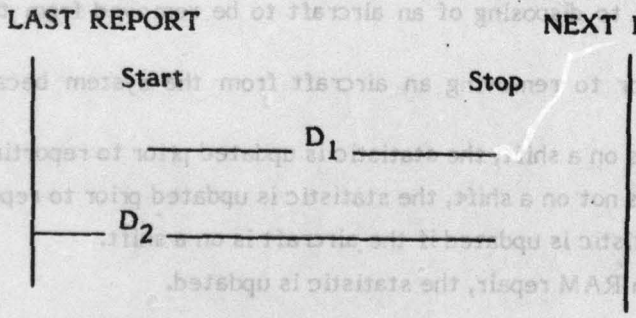
At PSR time, the aircraft flying days is divided by OLD NO. 14, and multiplied by 100 to calculate the percentage.

START



At START time, the value D_1, D_2 and D_3 would be added (in days) to the statistic.

REMOVE



At STOP time, only D_2 is added to the statistic.

OLD NO. 16 PCT UNSCHEDULED MAINTENANCE

This statistic is calculated in three places.

When an aircraft is at end of network, the total days in unscheduled maintenance is added to the statistic.

At PSR time, all aircraft in all sets are updated and the total time currently spent in unscheduled maintenance is added to the statistic.

At PSR time, the total number of aircraft days spent in unscheduled maintenance is divided by the number of aircraft days available and multiplied by 100 to arrive at the percentage. It must be pointed out that the time in unscheduled maintenance is calculated according to a statistics hierarchy of unscheduled maintenance, scheduled maintenance, NORS. That is, if the aircraft has a single unscheduled job in process, it is considered in unscheduled maintenance. It is only in one of the other categories if it has no inprocess unscheduled maintenance tasks. The task coding scheme identifies the task type.

OLD NO. 17 PCT SCHEDULED MAINTENANCE

This statistic is calculated in three places.

When an aircraft is at end of network, the total days in both scheduled and unscheduled maintenance is added to the statistic.

At PSR time, all aircraft in all sets are updated and the total time spent in unscheduled and scheduled maintenance is added to the statistic.

At PSR time, the unscheduled time is subtracted from the total and the result is divided by the aircraft days available and multiplied by 100 to arrive at the percentage. Once again, the statistical hierarchy is followed.

OLD NO. 18 PCT NORS

This statistic is calculated in five places.

When a scheduled maintenance task is started and there are no scheduled or unscheduled jobs in process and the aircraft is in a NORS condition, its status is changing from NORS to scheduled maintenance. The time (days) the aircraft was NORS is added to the statistic.

When an unscheduled maintenance task is started and there are no scheduled or unscheduled tasks in process and the aircraft was in a NORS condition, the status is changing from NORS to unscheduled maintenance. The time (in days) the aircraft was NORS is added to the statistic.

As an aircraft completes a job considered "NORS" and has no in process scheduled or unscheduled maintenance or any NORS jobs, the time in the NORS condition is added to the statistic.

At PSR time, all aircraft in all sets are updated. If there are no scheduled or unscheduled jobs in process on the aircraft and there are some NORS jobs, the time (days) in the NORS condition is added to the statistic.

At PSR time, the total NORS time is divided by the aircraft days available and multiplied by 100 to arrive at the percentage. Once again the statistical hierarchy is followed.

OLD NO. 19 PCT MISSION WAIT STATUS

This statistic is calculated in four places.

When it has been decided that a mission is going to fly, the interval of time that aircraft flagged as 40 or 60 have been waiting is added to the statistic.

When a mission is being cancelled for the aircraft flagged as 40, the length of time (days) that they have been waiting is added to the statistic.

At PSR time, all aircraft in all sets are updated and the total time the aircraft flagged as 40 or 60 have spent waiting at a sortie task is added to the statistic.

At PSR time, the total mission wait days is divided by the aircraft days available and multiplied by 100 to arrive at the percentage.

OLD NO. 20 PCT SERVICE & MNT. WAIT

The number of aircraft days spent in service and maintenance wait is calculated as the residual of the total aircraft days available less the "OR" (see next STAT) days less the sum of flying days, unscheduled maintenance days, scheduled maintenance days and mission wait days. The result is divided by aircraft days available and multiplied by 100 to arrive at the percentage.

OLD NO. 21 PCT OPERATIONALLY READY

This statistic is calculated by every time an aircraft is placed in or removed from a cocked set or avail set of aircraft. The total time the aircraft are in these sets is the pure Operationally Ready (OR) time.

At PSR time, the number of aircraft days in pure Operationally Ready (OR) status is divided by the number of aircraft days available and the result is multiplied by 100.

OLD NO. 22 AVG AC POST SORTIE TIME (HRS)

At the end of network processing for an aircraft, the total elapsed time from end of sortie task to end of network processing is added to the statistic.

At PSR time, this statistic is converted into hours and is divided by the number of aircraft turnarounds to obtain the statistic.

OLD NO. 23 AVG NO. OF SORTIES/AIRCRAFT/DAY

In mission start time, the statistic is incremented by one for each aircraft flying a mission.

At PSR time, the statistic is divided by the aircraft days available to obtain the average number of sorties flown per aircraft per day.

OLD NO. 24 FLYING HOURS

As discussed under OLD NO. 15, the flying days is converted at PSR time and reported as flying hours.

T7 NUMBER OF FCF TASKS FLOWN

When an aircraft starts an FCFTASK, one is added to the statistic.

T8 AVG AIRCRAFT PRE-SORTIE TIME (HRS)

When an aircraft hits the sortie task for the first time for a mission and is not flagged as 101 or smaller, one is added to a counter and the elapsed time since assignment to the mission and reaching the sortie task is added to the statistic. The average is computed at PSR report time.

C. PERSONNEL STATISTICS

OLD NO. 27 MANHOURS AVAILABLE (100)

This statistic is calculated in four places.

At PSR time, the duration (days) since the last shift change or last statistic update for the shift for a resource on a shift is determined. For each resource on that shift, the mandays authorized or available is calculated and added to the statistic.

At PSR time, if the resource is not on a shift, the authorized level times the level one reporting interval is added to the statistic.

At shift starting time, the duration (days) since the last shift change or the last statistics update for the shift for a resource on a shift is determined. For each resource on that shift, the mandays authorized or available is calculated and added to the statistic.

At PSR time, the statistic is converted to manhours and divided by 100.

At PSR time, the statistic is used as described below.

OLD NO. 28 PERCENT UTILIZATION

At PSR time, the statistic is calculated by dividing the manhours used (100) by the manhours available (100) and multiplying by 100.

OLD NO. 29 MANHOURS USED (100)

At PSR time, the statistic is calculated by adding the manhours used in unscheduled maintenance and scheduled maintenance (all divided by 100). This implies that men should not be placed on other types of tasks or the manhours will not be reported properly.

OLD NO. 30 PCT UNSCHED MAINTENANCE OF STAT 29

This statistic is calculated in four places.

As a job ends which has processed an unscheduled task type, the quantity of each type of man on the task times either the duration of the task, if completed within a single reporting period, or the portion completed in the current reporting period, is added to the statistic.

At PSR time, each job in process that has a man assigned to it will determine the amount of mandays expended up to that time. If the task type is unscheduled maintenance, the mandays are added to the statistic.

At PSR time, the mandays are converted into manhours and divided by 100.

At PSR time, the converted hours are divided by the converted total hours used and multiplied by 100 to arrive at the percentage.

OLD NO. 31 PCT SCHED MAINTENANCE OF STAT 29

This statistic is calculated in four places.

As a job ends which has processed a scheduled task type, the quantity of each type of man on the task, times either the duration of the task if started and completed within a single reporting period, or the portion completed in the current reporting period, is added to the statistic.

At PSR time, at performance summary report time, each job in process that has a man assigned to it will determine the amount of mandays expended up to that time. If the task type is not unscheduled maintenance, the mandays are added into scheduled maintenance days regardless of task type.

At PSR time, the mandays are converted into manhours and divided by 100.

At PSR time, the converted hours are divided by the converted total hours used and multiplied by 100 to arrive at the percentage.

NEW NO. P1 PCT PRIME OF STAT 29

This statistic is calculated in four places.

As a job ends which has processed as a scheduled or unscheduled maintenance type task, the quantity of each type of prime man on the task times either the duration of the task, if completed within a single reporting period, or the portion completed in the current reporting period, is added in mandays to the statistic. Note that a type 7, base repair task, is considered as unscheduled maintenance type task. A prime resource for a task is a resource defined on the LCOM II Form 12 record. If a resource is not a prime it is a substitute. A substitute is any general substitute, or resources defined only on LCOM II Form 12A records.

At PSR time, for each job in process that has a man assigned to it, the amount of mandays expended during the summary period just ending is determined. If the task type is scheduled or unscheduled maintenance and the man is a prime resource, the mandays are added to the statistic.

At PSR time, the mandays are converted into manhours and divided by 100.

At PSR time, after the converted hours of stat 30 plus stat 31 have been stored in stat 29, the converted hours in P1 is divided by the converted hours in stat 29 and multiplied by 100 to arrive at the percentage.

NEW NO. P2 PCT SUBSTITUTE OF STAT 29

This statistic is calculated in four places.

As a job ends which has processed as a scheduled or unscheduled maintenance type task, the quantity of each type of substitute man on the task times either the duration of the task, if completed within a single reporting period, or the portion completed in the current reporting period, is added in mandays to the statistic. A substitute resource is not only a general substitute but is also any resource defined on LCOM II Form 12A records but not on the Form 12 record for a specific task.

At PSR time, for each job in process that has a man assigned to it, the amount of mandays expended during the summary period just ending is determined.

If the task type is scheduled of unscheduled maintenance and the man is a substitute resource, the mandays are added to the statistic

At PSR time, the mandays are converted into manhours and divided by 100.

At PSR time, after the converted hours of stat 30 plus stat 31 have been stored in stat 29, the converted hours in P2 is divided by the converted hours in stat 29 and multiplied by 100 to arrive at the percentage.

NEW NO. 33 NUMBER OF MEN DEMANDED

This statistic is calculated in one place.

At task setup time, this statistic is calculated for each prime man resource prior to scaning their on-hand balances. The quantity demanded of the prime man for the task is added to the statistic. The statistic is updated prior to the determination of which resources will be passed from the scan process to the task starting process. Therefore, this statistic reflects only prime resource demands.

NEW NO. P3 NBR OF MEN DEMANDED POST SCAN

This statistic is calculated or used in two places.

At task setup time, for each type of man (prime or substitute) passed from the on-hand balance scanning process to the starting mechanism the statistic is updated by the number demanded.

At PSR time, this statistic is used in the calculation of percentages for stats 34, 35, 36, and 37. These statistics are calculated only at initial task starting time, not after it has been backordered and a subsequent restart attempted.

NEW NO. 34 % AVAIL BY OH.BAL. OF RESOURCE

This statistic is collected in two places.

At task setup time, the portion or quantity of demands for men that can be satisfied for the prime resource from the on-hand balance is calculated. This does not mean that the task requesting the resources will necessarily start.

At PSR time, the statistic is divided by the number of men demanded and multiplied by 100 to arrive at the percentage.

NEW NO. 35 % AVAIL BY GEN SUBS OF RES

This statistic is collected in two places.

At task time, the portion or quantity of demands for men that can be satisfied for the prime resource by using the on-hand quantities of substitute resources is calculated. This does not mean that the task requesting the resources will necessarily start.

At PSR time, the statistic is divided by the number of men demanded and multiplied by 100 to arrive at the percentage.

NEW NO. 36 % AVAIL BY EXPEDITE

This statistic is calculated in two places.

At task setup time, the quantity of men demanded which could not be provided by the existing on-hand balances of prime and substitute resources, but that can be provided by the expedite procedure (unless preempted by future demands), is calculated.

At PSR time, the statistic is divided by the number of men demanded and multiplied by 100 to arrive at the percentage. Note: The word provided (PROV) in the title should more appropriately be AVAILABLE (AVAIL).

NEW NO. 37 % AVAIL BY PREEMPTION PROCESS

This statistic is calculated in two places.

At task setup time, the quantity of men demanded and not provided by the existing on-hand balances of prime and substitute resources, but that are provided by preempting other tasks, is calculated.

At PSR time, the statistic is divided by the number of men demanded and multiplied by 100 to arrive at the percentage.

OLD NO. 38 PCT DEMANDS NOT SATISFIED

This statistic is calculated in two places.

At task setup time, the quantity of men demanded and not able to be satisfied by any of the above-mentioned methods is calculated.

At PSR time, the statistic is divided by the number of men demanded and multiplied by 100 to arrive at the percentage.

OLD NO. 39 OVERTIME MANHOURS USED (100)

This statistic is calculated in two places.

When a shift change occurs and men are to be removed from the simulation, if they are removed via an expedite procedure, the time in days remaining to end of the expedited task times the quantity of men removed by expedite is added to the statistic.

At PSR time, this statistic is converted into manhours and is divided by 100.

OLD NO. 40 MANHOURS PER FLYING HOUR

At PSR time, flying days is first converted into flying hours. The statistic is calculated by dividing the manhours used (OLD NO. 29) by flying hours and multiplying by 100. This is done because the manhours are divided by 100 previously and the quotient must be adjusted. It must be pointed out that this statistic is entirely dependent upon the portion of the real situation that is actually networked and has its tasks coded properly. It can only be interpreted properly as "Simulated Man Hours Per Flying Hour (MH/FH)."

D. SHOP REPAIR STATISTICS

OLD NO. 44 NO. OF REPARABLE GENERATIONS

This statistic is the sum of OLD NO. 45 and OLD NO. 46 before they are converted into percentages.

OLD NO. 45 PCT BASE REPAIR

This statistic is calculated in three places.

When a part reaches the end of network (returned to supply), and if it has not hit a depot repair task and has not been reported as a reparable generation in a PSR, it is reported as an active base repair.

At PSR time, if the part processing disposition has not been previously reported and has not hit a depot repair task, it is reported as an active base repair.

At PSR time, the percentage is calculated by dividing the current value by the number of reparable generations and multiplying by 100.

OLD NO. 46 PCT DEPOT REPAIR

This statistic is calculated in three places.

When a part reaches the end of network (returned to supply), and if it has nit a depot repair task and has not been reported as a reparable generation in a PSR, it is reported as a depot repair.

At PSR time, if the part processing disposition has not been previously reoorted and has hit a depot repair task, it is reported as a depot repair.

At PSR time, the percentage is calculated by dividing the current value by the number of reparable generations and multiplying by 100.

When a part hits a depot repair task, a depot flag is set to 1.

Thus, at PSR time, one can have parts with a depot flag of 0, 1, 2, 3. The (2) and (3) will not collect statistics because they have been previously reported. The (0) and (1) will be reported and will be changed to (2) and (3) respectively. At the time when parts are returned to supply, their depot flag values can be 0, 1, 2 and 3. The (2) and (3) will not collect statistics.

OLD NO. 47 AVERAGE BASE REPAIR CYCLE

This statistic is calculated in two places.

When a part is returned to supply (reached end of network) from a reparable generation, and if the part was processed as an active repair (did not encounter a depot repair task), the elapsed time from part generation until return to supply is added to the statistic.

At PSR time, the statistic is divided by the number of reparable generations returned to supply (see OLD NO. 49).

OLD NO. 48 PCT ACTIVE REPAIR

This statistic is calculated in two places.

When a part is returned to supply (reached end of network) from a reparable generation, and if the part was processed as an active repair (did not encounter a depot repair task), the elapsed time that the part was in either scheduled or unscheduled maintenance is added to the statistic.

At PSR time, the statistic is divided by total elapsed time from part generation until return to supply (OLD NO. 47 before calculating the average), and multiplied by 100 to obtain a percentage.

OLD NO. 49 PCT WHITE SPACE

This statistic is calculated in two places.

When a part is returned to supply from a reparable generation, a value of one is added to the statistic. This is only the number actually returned to supply and does not necessarily correspond to OLD NO. 44.

At PSR time, this value is used to calculate average base repair cycle. Also in SHOPS, the percentage white space is determined by subtracting OLD NO. 48 from 100. In reality, this statistic represents the portion of total elapsed time that a part processed from generation until return to supply as an active repair (did not encounter a depot repair task), that was spent not processing a scheduled or unscheduled maintenance task.

OLD NO. 50 NO. OF ITEMS IN REPAIR (EOP)

This statistic is calculated at PSR time. It is the total number of parts (reparable generation) currently processing in the network which have at least one scheduled or unscheduled task in process. Note: STAT Title might more appropriately be "NO. OF ITEMS IN ACTIVE REPAIR (EOP)."

OLD NO. 51 NO. OF ITEMS BACKLOGGED (EOP)

This statistic is calculated at PSR time. It is the total number of parts (reparable generation) currently processing in the network which have no scheduled or unscheduled tasks in process.

E. SUPPLY STATISTICS

OLD NO. 54 TOT DOLLAR INVEST (1000) (EOP)

At PSR time, this statistic is calculated as the current authorized level of the part multiplied by the unit cost and authorized level of the part multiplied by the unit cost and is added to the current value. It is then divided by 1000 to reflect the cost in units of 1000.

OLD NO. 55 FILL RATE PERCENT

At task setup time, the portion of demand for a part resource that can be satisfied from the on-hand balance of the prime part is added to the statistic.

At PSR time, this statistic is divided by the number of parts demanded (OLD NO. 57) and multiplied by 100 to arrive at the percentage.

OLD NO. 56 NUMBER OF BACKORDER DAYS

This statistic is calculated in six places.

At task setup time, the difference between the on-hand balance and due-out balance for parts is calculated when the part is on a task which is starting. If the on-hand balance cannot cover the due-out balance, the amount not covered, multiplied by either the interval of time since the last statistic change or last report period for the statistic, is added to the statistic.

When a part is returned to supply, a similar calculation is performed.

When a request for a part is placed in the backorder threads, a similar calculation is performed.

When a part resource assigned to a job is removed from the in-process or backorder threads, a similar calculation is performed.

At shift start-up time, where resources are being added to or removed from the system, a similar calculation is performed for all part resources.

OLD NO. 57 NUMBER OF UNITS DEMANDED

At task set-up time, for each part demanded on a task, the quantity demanded is added to the statistic.

At PSR time, this statistic is used to calculate the fill rate as well as the percentages discussed below.

Statistics OLD NO. 58 -- OLD NO. 61 are calculated only at initial task starting time, not after a backorder.

OLD NO. 58 PCT OFF-THE-SHELF

At task starting time, the portion of a demand for a part that can be satisfied by either the prime or substitute part's on-hand balance is added to the statistic.

At PSR time, this statistic is divided by the number of parts demanded (OLD NO. 57) and multiplied by 100 to arrive at the percentage.

OLD NO. 59 PCT EXPEDITED REPAIR

At task set-up time, the portion of parts demanded which could not be provided by the existing on-hand balances of prime and substitute resources, but that can be provided by the expedite procedure, is calculated.

At PSR time, this statistic is divided by the number of parts demanded (OLD NO. 57) and multiplied by 100 to arrive at the percentage.

OLD NO. 60 PCT PREEMPTION

At task set-up time, the quantity of parts demanded and not provided by the existing on-hand balances of prime and substitute resources but that are provided by preempting other tasks is calculated.

At PSR time, this statistic is divided by the number of parts demanded (OLD NO. 57) and multiplied by 100 to arrive at the percentage.

OLD NO. 61 PCT DEMANDS NOT SATIS.

At task start-up time, the quantity of parts demanded and not able to be satisfied by any of the above-mentioned methods is calculated.

At PSR time, the statistic is divided by the number of parts demanded (OLD NO. 57) and multiplied by 100 to arrive at the percentage.

OLD NO. 62

Not calculated.

OLD NO. 63 NO. OF ITEMS ON BACKORDER

The quantity of an item which is on backorder at the time a PSR is produced. At PSR time, the difference between the due out balance and the on-hand balance is calculated, stored, and added to the statistic.

F. EQUIPMENT STATISTICS

OLD NO. 68 TO. DOLLAR INVEST. (1000) (EOP)

At PSR time, the current authorized level of the resource is determined. This level is multiplied by a unit cost and added to the statistic. It is an end of period snapshot statistic.

At PSR time, this statistic is divided by 1000 before printing.

OLD NO. 69 EQUIPMENT HOURS AUTH (100)

At PSR time, the collected statistic is converted into hours and divided by 100.

At shift start-up time, the resources-days authorized on the current shift are calculated and added to the statistic. These are calculated on the basis of the duration of that shift or the last time of update of that shift's statistics.

At shift start-up time, if the resource is on a shift, the resource days authorized on the current shift are calculated on the basis of the duration of that shift or the last time of update of that shift's statistics.

At PSR time, if the resource is not on a shift, the resource days are calculated using the level one report period and added to the statistic.

OLD NO. 70 EQUIPMENT HOURS AVAIL. (100)

At PSR time, the collected statistic is converted into hours and divided by 100.

At shift start-up time, the resource days authorized for the resource are computed by multiplying the resource's current authorized level by the elapsed time since a statistics update was performed or the shift was started.

At shift start-up time, if the resource is on a shift, the resource days authorized for the resources are computed by multiplying the resource's current authorized level by the elapsed time since either a statistics update or a shift change.

At PSR time, if the resource is not on a shift, the resource days are calculated using the level one report period and added to the statistic.

At PSR time, the statistic is used to calculate OLD NO. 71 and OLD NO. 72.

OLD NO. 71 PCT USED-UNSCHED MAINT

This statistic is calculated in three places.

As a job ends which has processed an unscheduled task type, the quantity of each type of equipment on the task, multiplied by either the duration of the task (if started and completed within a single reporting period), or the portion completed in the current reporting period, is added to the statistic.

At PSR time, at performance summary report time, each job in process that has equipment assigned to it will determine the equipment days expended up to that time. If the task type is unscheduled maintenance the equipment days are added to the statistic.

At PSR time, the statistic is divided by OLD NO. 70 to arrive at the percentage. The base statistic is then converted into hours.

OLD NO. 72 PCT USED-SCHED MAINT

This statistic is calculated in three places.

As a job ends which has processed a scheduled task type, the quantity of each type of equipment on the task, multiplied by either the duration of the task (if started and completed within a single reporting period), or the portion completed in the current reporting period, is added to the statistic.

At PSR time, at performance summary report time, each job in process that has equipment assigned to it will determine the amount of equipment days expended up to that time. If the task type is not unscheduled maintenance the equipment days are added into scheduled maintenance regardless of task type.

At PSR time, the statistic is divided by OLD NO. 70 to arrive at the percentage. The base statistic is then converted into hours.

OLD NO. 73 PCT UNUSED

This statistic is the residual value of 100 minus OLD NO. 72 and OLD NO. 73. It represents the percentage of unused equipment hours.

OLD NO. 74 NUMBER OF BACKORDER-DAYS

This statistic is calculated in six places.

At task set-up time, the difference between the on-hand balance and due-out balance for equipment is calculated when the equipment is on a task which is starting. If the on-hand balance cannot cover the due-out balance, the quantity not covered multiplied by either the interval of time since the last statistic change, or last report period for the statistic, is added to the statistic.

When a piece of equipment is returned to supply, a similar calculation is performed.

When a request for equipment is placed into the backorder threads, a similar calculation is performed.

When an equipment resource assigned to a job is removed from the in-process or backorder threads, a similar calculation is performed.

At shift start-up time, when resources are being added to, or removed from the system, a similar calculation is performed.

At PSR time, at performance summary report time, a similar calculation is performed for all equipment resources.

OLD NO. 75 NUMBER OF UNITS DEMANDED

This statistic is calculated or used in two places.

At task set-up time, for each piece of equipment demanded on a task, the statistic is calculated.

At PSR time, the statistic is used to calculate the various percentages discussed below.

Statistics OLD NO. 76 -- OLD NO. 79 are calculated only at initial task starting time, not after a backorder.

OLD NO. 76 PCT AVAILABLE

At task start-up time, the portion of a demand for equipment that can be satisfied by either the prime resource or substitute resources' on-hand balance is added to the statistic.

At PSR time, this statistic is divided by the number of pieces of equipment demanded (OLD NO. 75) and multiplied by 100 to arrive at the percentage.

OLD NO. 77 PCT BY EXPEDITE

At task set-up time, the portion of equipment demanded which could not be provided by the existing on-hand balances of prime and substitute resources, but that can be provided by the expedite procedure, is calculated.

At PSR time, this statistic is divided by the number of pieces of equipment demanded (OLD NO. 75) and multiplied by 100 to arrive at the percentage. Note: The word PROV in the title should be AVAIL (available).

OLD NO. 78 PCT PROV. BY PREEMPTION

At task set-up time, the quantity of equipment demanded and not provided by the existing on-hand balance of prime and substitute resources, but that are provided by preempting other tasks, is calculated.

At PSR time, this statistic is divided by the number of pieces of equipment demanded (OLD NO. 75) and multiplied by 100 to arrive at the percentage.

OLD NO. 79 PCT DEMANDS NOT SATIS.

At task start-up time, the quantity of equipment demanded and not able to be satisfied by any of the above-mentioned methods is calculated.

At PSR time, the statistic is divided by the number of pieces of equipment demanded (OLD NO. 75) and multiplied by 100 to arrive at the percentage.

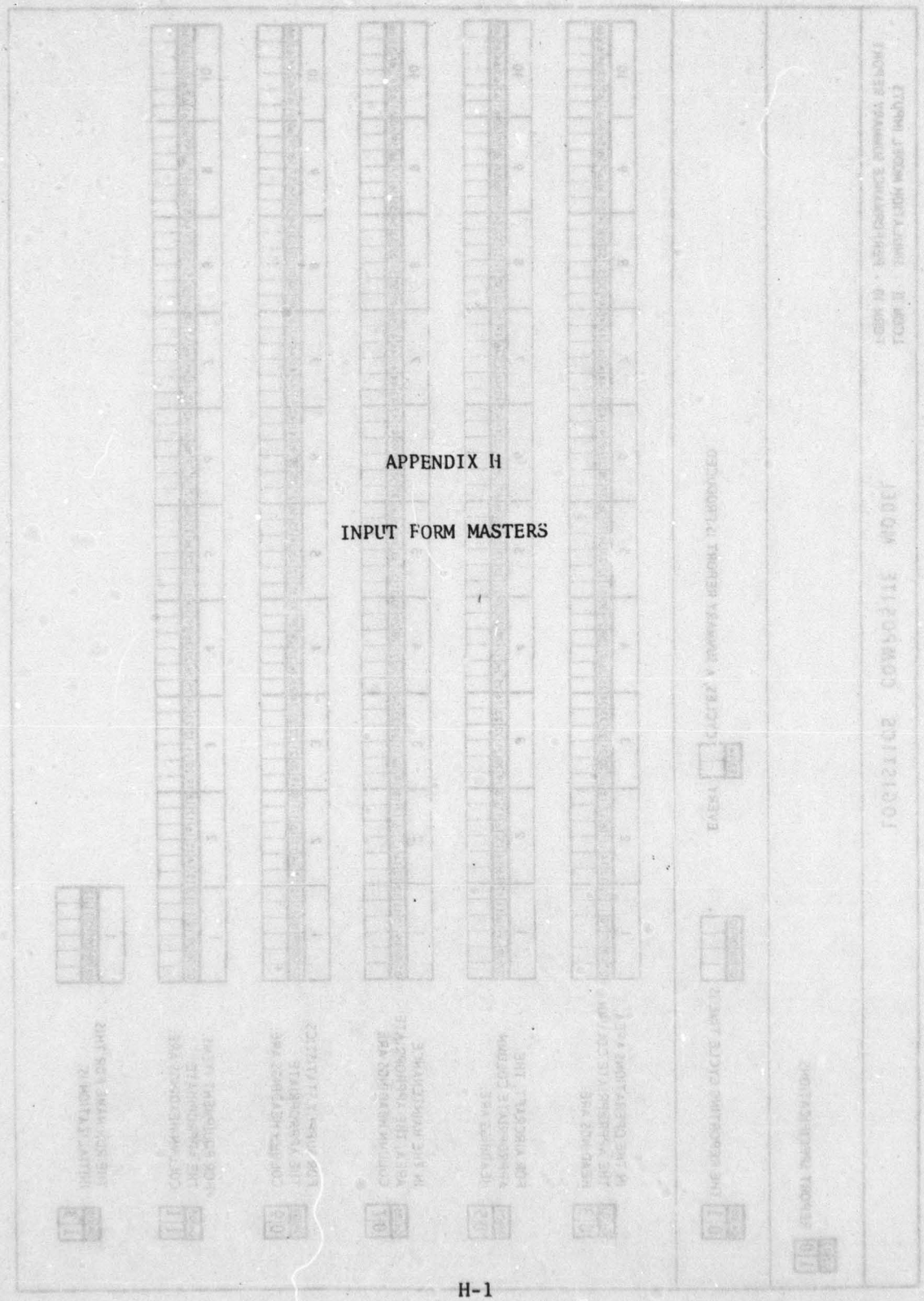
OLD NO. 80 EQUIP HOURS BACKLOG (100) (EOP)

At PSR time, the remaining task time multiplied by the quantity of equipment on each task backordered for an equipment resource is added to the statistic.

At PSR time, the statistic is converted to hours and divided by 100.

APPENDIX H

INPUT FORM MASTERS



02 03
1 0 REPORT SPECIFICATIONS

04 05
0 1 THE REPORTING CYCLE TIME IS 07 08 09 10 . EVERY 13 14 CYCLES, A SUMMARY REPORT IS PRODUCED.

04 05
0 3 IN THE OPERATIONS AREA, THE APPROPRIATE COLUMN HEADINGS ARE:

04 05
0 5 FOR AIRCRAFT, THE APPROPRIATE COLUMN HEADINGS ARE:

04 05
0 7 IN THE MAINTENANCE AREA, THE APPROPRIATE COLUMN HEADINGS ARE:

04 05
0 9 FOR SUPPLY STATISTICS, THE APPROPRIATE COLUMN HEADINGS ARE:

04 05
1 1 FOR EQUIPMENT ITEMS, THE APPROPRIATE COLUMN HEADINGS ARE:

04 05
1 3 THE RUN NAME FOR THIS INITIALIZATION IS: 07 08 09 10 11 12

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 11 - TASK NETWORK

CARD I.D.	PRIOR NODE	TASK I.D.	NEXT NODE	SEL. MODE	SELECTION PARAMETER	TASK DESCRIPTION
01 02 03	04 05 06 07 08 09 10	11 12 13 14 15 16 17	18 19 20 21 22 23 24	25	26 27 28 29 30 31 32	33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
1 1						

● SELECT MODE: A = Any, B = Constrained, C = Call sub-network, D = By task, E = Either, F = Failure controlled, G = Get one, H = Halt, I = Ignore (cond'l), J = Jump, K = Kill, R = Resource availability, S = Sortie, T = Trigger

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 12 - TASK DEFINITIONS

CARD I.D.	○ Blank or A	TASK I.D.	◉ Cond "IC"	Task Type	Priority	TASK DURATION: MEAN (OPTIM) ◒	TASK DURATION: VARIANCE (LIKELY) ◒	DIST	*	ASSOCIATED RESOURCE/ RCS ◑	TASK RESOURCE REQUIREMENTS: RESOURCE	C	QTY.	RESOURCE	C	QTY.	RESOURCE	C	QTY.	TRIANGULAR DISTRIBUTION (PESSIM) ◒
01 02 03	04	05 06 07 08 09 10	11	12	13	14 15 16 17 18 19 20	21 22 23 24 25 26	27	28	29 30 31 32 33 34 35	36 37 38 39 40 41 42	43	44 45	46 47 48 49 50 51	52	53 54	55 56 57 58 59 60	61	62 63	64 65 66 67 68 69 70
1 2																				

◉ TASK TYPE: 1 = Sortie, 2 = Unsched. Maint., 3 = Sched. Maint., 4 = First Depot Repair Task, 5 = Other (delays only, 6 = Condemned, 7 = First base repair (treated as unscheduled.)

◒ For triangular distribution - input optimistic (optim), most likely (likely) and pessimistic (pessim) in columns indicated.

○ Applicable to Model Version 3.0.

◑ Resource Combination Set (Form 12A)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 13 - RESOURCE DEFINITIONS

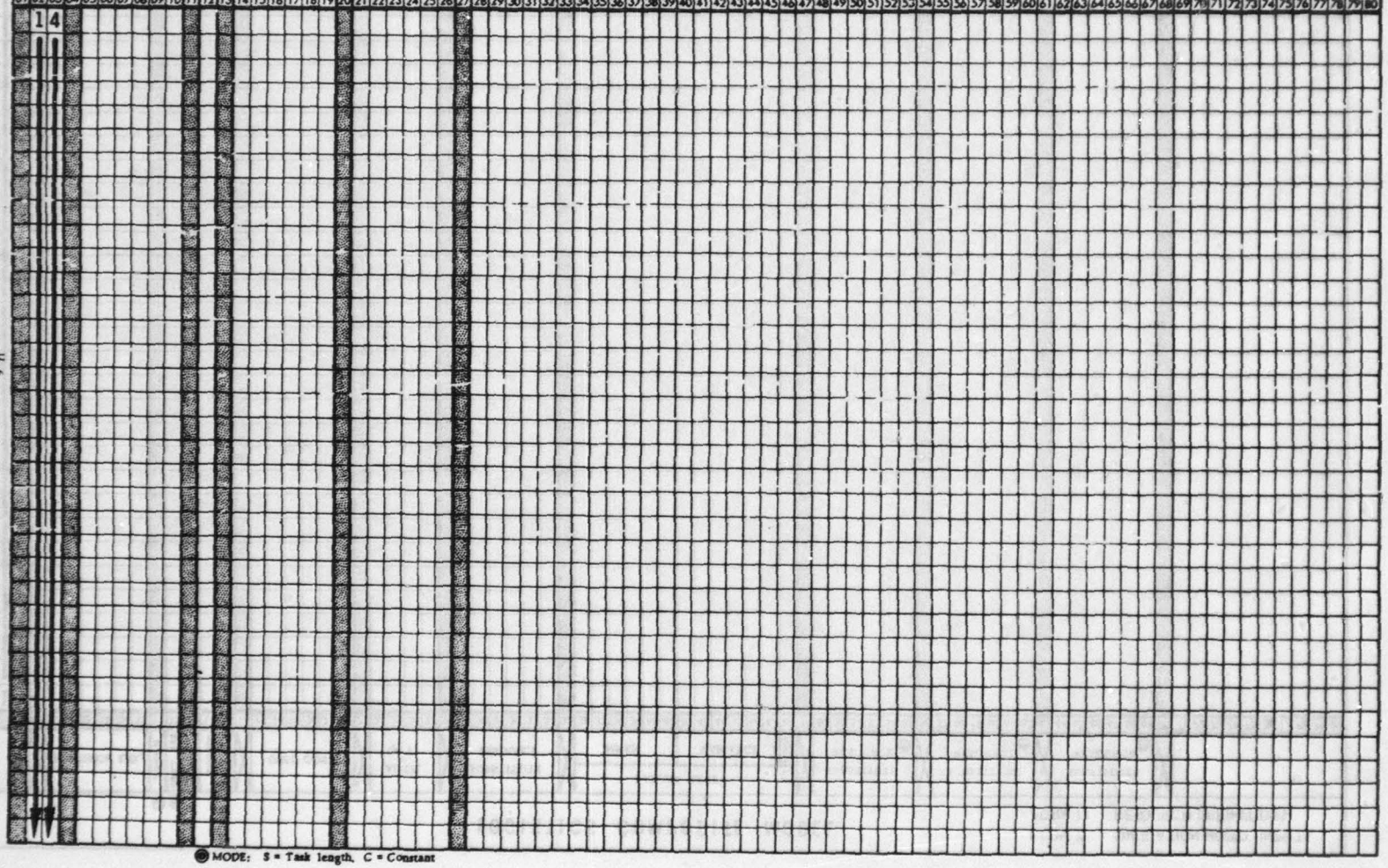
01	02 03	04	05 06 07 08 09 10	11	12	13	14 15	16	17 18 19 20 21 22	23	24 25 26 27	28	29 30 31 32 33 34	35	36 37 38 39 40 41	42 43 44 45 46 47	48	49	50 51 52 53 54 55	56	57 58 59 60 61 62	63	64 65 66 67 68 69	70	71 72 73 74 75 76 77 78 79 80
	CARD I.D.		RESOURCE I.D.	ENTRY ◒	RES. TYPE ◉		REPORT COLUMN		UNIT COST		AUTH. QTY		SUBSTITUTE RESOURCE		FAILURE RATE MEAN	FAILURE RATE VARIANCE	DIST ○		SUBSTITUTE RESOURCE ◓		SUBSTITUTE RESOURCE ◓		SUBSTITUTE RESOURCE ◓		
	1 3																								

◉ RESOURCE TYPE: I = Aircraft, P = Parts, M = Men, A = AGE, or Facilities, C = Clock.
◒ An * indicates resource can enter network.
○ Triangular distribution not allowed on this form.
◓ Applicable to Model Version 3.0.

H-5

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 14 - FAILURE CLOCK DECREMENTS



MODE: S = Task length, C = Constant

LOGISTICS COMPOSITE MODEL

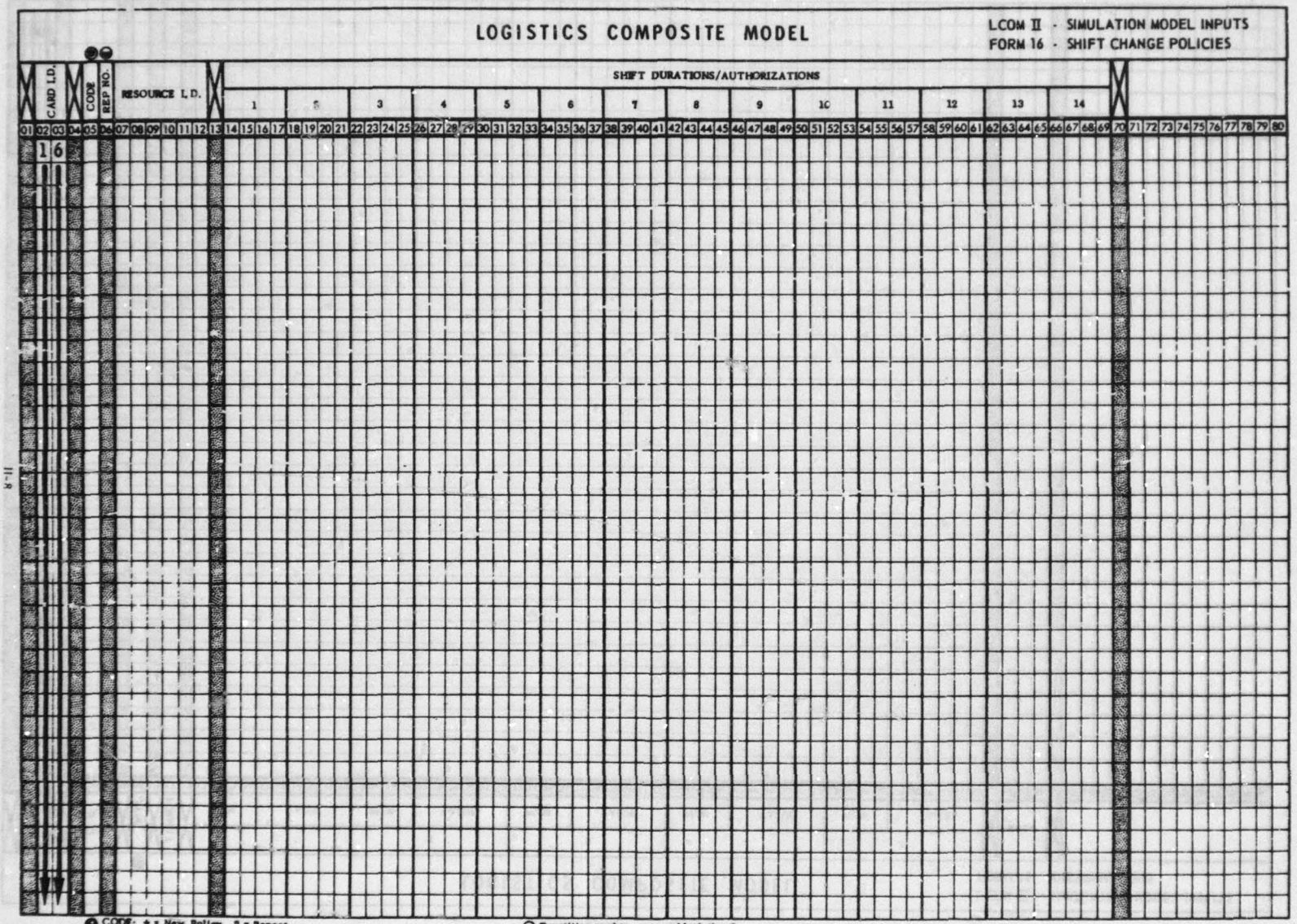
LCOM II - SIMULATION MODEL INPUTS
FORM 15 - DISTRIBUTIONS

01	02 03	04	05 06 07	08	09	10	11	12	13 14 15 16	17 18 19 20 21 22	23 24 25 26	27 28 29 30 31 32	33 34 35 36	37 38 39 40 41 42	43 44 45 46	47 48 49 50 51 52	53 54 55 56	57 58 59 60 61 62	63	64 65 66	67	68 69 70 71 72 73 74 75 76 77 78 79 80
	CARD I.D.		DISTN I.D.		TYPE		FORMAT		1 PROB	1 VALUE	2 PROB	2 VALUE	3 PROB	3 VALUE	4 PROB	4 VALUE	5 PROB	5 VALUE		MULT		
	15																					

● TYPE: I = Interpolate
S = Step Function

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 16 - SHIFT CHANGE POLICIES

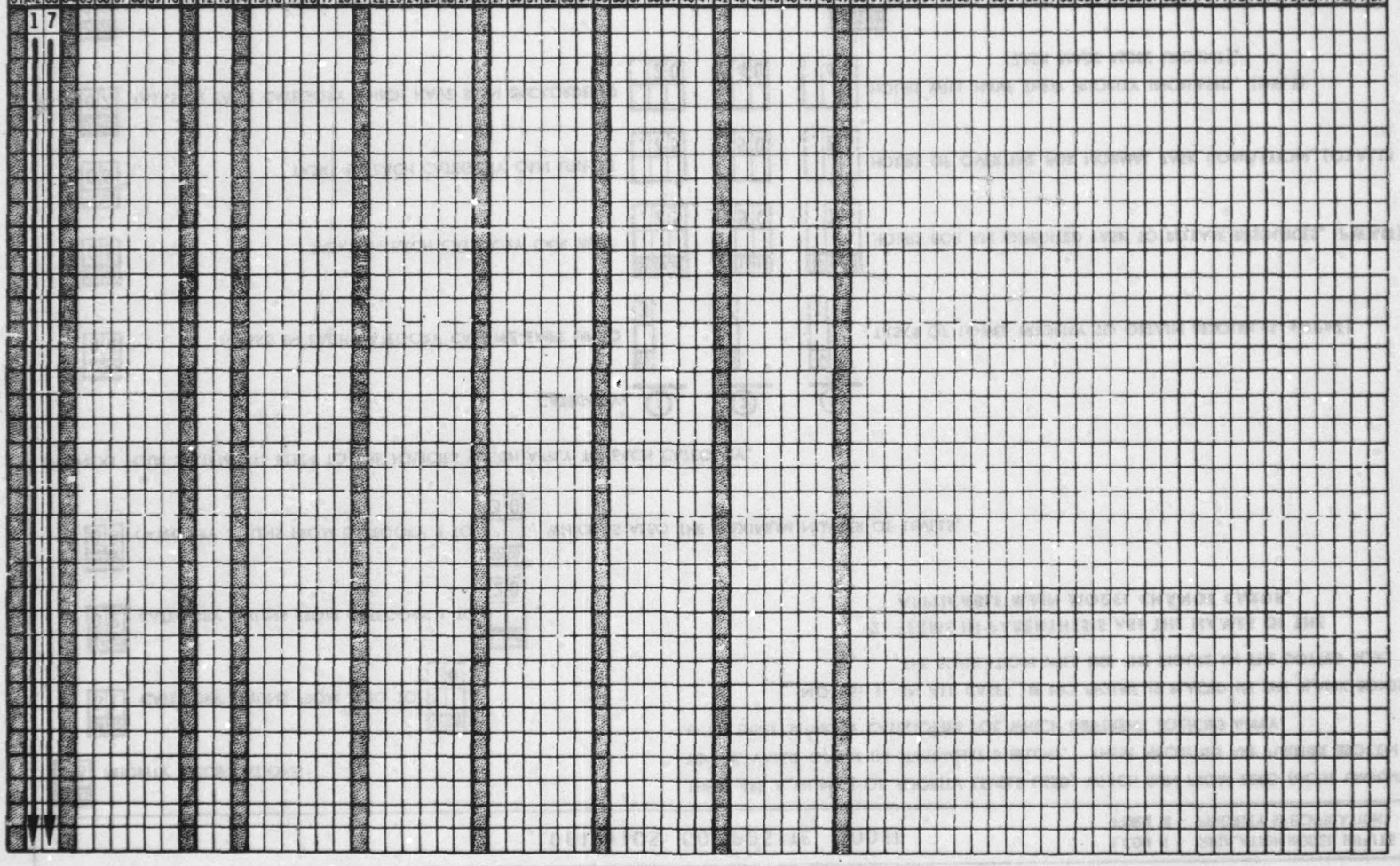


CODE: * = New Policy, R = Repeat

Repetition number - zero or blank thru 9.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 17 - MISSION/ACTIVITY ENTRY POINTS



LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 18 - PRIORITY SPECIFICATIONS

02 03 | 1 8 PRIORITY SPECIFICATIONS

THERE ARE A NUMBER OF PRIORITY LEVELS USED, WHICH RUN FROM ZERO (MOST URGENT) TO THE VALUE GIVEN IN STATEMENT 3 BELOW. THESE PRIORITIES ARE FURTHER BROKEN INTO THREE SEPARATE CATEGORIES FOR WHICH DIFFERENT POLICIES APPLY.

NOTES: 1. IN ALL CASES, IF NO FIGURE IS PLACED IN THE BLANK BOXES, THE SIMULATION WILL USE THE FIGURE IN THE DOTTED BOX.

2. TERMS IN PARENTHESIS ARE THE NAMES OF THE APPLICABLE MAIN MODEL CHANGE CARDS.

04 05 | 0 1 CATEGORY 1 RUNS FROM ZERO TO 07 08 | 1 0 .

04 05 | 0 2 CATEGORY 2 RUNS FROM CATEGORY 1 TO 07 08 | 2 0 .

04 05 | 0 3 CATEGORY 3 RUNS FROM CATEGORY 2 TO 07 08 | 3 0 , WHICH IS ALSO THE MAXIMUM NUMBER OF LEVELS.

THE NEXT FOUR STATEMENTS REFER TO THE POLICIES WHICH APPLY TO EACH CATEGORY.

	CATEGORY: ①	②	③	
04 05 | 0 4	TASKS IN EACH CATEGORY CAN PRE-EMPT UP TO 07 | 3	13 | 2	19 | 1	TASKS OF LOWER PRIORITY TO OBTAIN RESOURCES. (NPRE)
04 05 | 0 5	TASKS IN EACH CATEGORY CAN WAIT 07 08 09 | . 2 5	13 14 15 | . 5 0	19 20 21 | . 7 5	HOURS FOR AN EXPEDITED TASK TO RELEASE RESOURCES. (PWAIT)
04 05 | 0 6	TASKS IN EACH CATEGORY CAN UTILIZE . 7 5	. 5 0	. 2 5	HOURS OF OVERTIME FOR NORMAL TASK COMPLETION. (OTALL)
04 05 | 0 7	TASKS IN EACH CATEGORY WHICH HAVE BEEN BACKORDERED 2 0	4 8	4 8	HOURS WILL HAVE THEIR PRIORITY INCREASED. (DELT) (TASK MADE MORE URGENT).

04 05 | 0 8 ANY TASK MAY BE EXPEDITED BY SHORTENING THE REMAINING PROCESSING TIME TO 07 08 09 | . . | 1 . 0 OF ITS VALUE. (EXPED)

04 05 | 0 9 IF A TASK IS INTERRUPTED BY PRE-EMPTION, ITS REMAINING PROCESSING TIME IS INCREASED BY A FACTOR OF 07 08 09 | . . | 1 . 0 . (PCT)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 20 - SORTIE GENERATION DATA

01 02 03	04 05 06 07	08 09 10 11 12	13 14	15 16 17 18	19 20 21 22 23 24 25	26 27 28 29 30 31 32	33 34 35 36 37 38 39	40 41 42 43 44 45 46 47 48 49 50 51 52 53	54 55 56 57 58	59 60 61 62 63	64 65 66	67 68 69 70 71 72 73	74 75 76 77 78 79 80
CARD I.D.	DAY	NUMBER OF MISSIONS OR ACTIVITIES		TAKEOFF OR ACTIVITY TIME	AIRCRAFT I. D. OR RESOURCE I. D.	MISSION I. D. OR ACTIVITY I. D.	MISSION SIZE: MIN / MAX ● / SPARE	MISSION LENGTH: MEAN (OPTIM) ◒ / VARIANCE (LIKELY) ◒ / DIST ○	LEAD TIME ○	CANCEL TIME	PRIORITY	CYCLE: INT / STOP	TRIANGULAR DISTRIBUTION (PESSIM) ◒
20													
77													

◒ For triangular distribution use - input optimistic (optim), most likely (likely), and pessimistic (pessim) in columns indicated. Cannot be used with TACMOD feature or card sequence numbers.

● Max field is the only size field applicable to activities.

○ Must be zero or blank for activities.

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 21 - AIRCRAFT ASSIGNMENT SEARCH PATTERNS

CARD I.D.	AIRCRAFT ASSIGNMENT SEARCH PATTERN	CONT. INCH	*	EXTERNAL		INTERNAL		CUT-OFF TIME (HOURS)	SP. SKIP	*	EXTERNAL		INTERNAL		CUT-OFF TIME (HOURS)	SP. SKIP
				CONFIGURATION NAME	RECONFIGURATION ENTRY NODE	EQUIPMENT GROUP	RECONFIGURATION ENTRY NODE				CONFIGURATION NAME	RECONFIGURATION ENTRY NODE	EQUIPMENT GROUP	RECONFIGURATION ENTRY NODE		
01 02 03	04 05 06 07 08 09 10	11	12	13 14 15 16 17 18	19 20 21 22 23 24	25 26 27 28 29 30	31 32 33 34 35 36	37 38 39 40 41	42	43	44 45 46 47 48 49	50 51 52 53 54 55	56 57 58 59 60 61	62 63 64 65 66 67	68 69 70 71 72	73
2 1																

* "C" for cocked aircraft or "A" for available aircraft

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 22 - INTERNAL EQUIPMENT AUTHORIZATIONS/CHANGES

CARD I.D.	AIRCRAFT NAME	CONT *(+)	INTERNAL EQUIPMENT				INTERNAL EQUIPMENT				INTERNAL EQUIPMENT			
			TRIGGER NODE	EQUIPMENT NAME	*	AUTHORIZED QUANTITY	TRIGGER NODE	EQUIPMENT NAME	*	AUTHORIZED QUANTITY	TRIGGER NODE	EQUIPMENT NAME	*	AUTHORIZED QUANTITY
01 02 03	04 05 06 07 08 09 10	11	12 13 14 15 16 17	18 19 20 21 22 23	24	25 26 27 28 29 30	31 32 33 34 35 36 37	38 39 40 41 42 43	44	45 46 47 48 49 50	51 52 53 54 55 56 57	58 59 60 61 62 63	64	65 66 67 68 69 70
2 2														

*Trigger Status (+ or –)

LOGISTICS COMPOSITE MODEL

LCOM II - SIMULATION MODEL INPUTS
FORM 23 - INTERNAL EQUIPMENT GROUP DEFINITIONS

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFMSMET REPORT 78-5.1	2. GOVT ACCESSION NO. AD-A083759	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) LCOM II SIMULATION SOFTWARE USERS REFERENCE GUIDE		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) WILLIAM F. DRAKE III and LT RAYMOND C. REISS		8. CONTRACT OR GRANT NUMBER(s) N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Force Maintenance & Supply Management Engineering Team, Wright-Patterson AFB OH 45433		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS N/A
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Maintenance & Supply Management Engineering Team, Wright-Patterson AFB OH 45433		12. REPORT DATE 12 October 1979 13. NUMBER OF PAGES 450
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Aircraft maintenance, aircraft support, computerized simulation, configuration control, field maintenance, inventory control, inventory policies, Logistics Management, Logistics Research, Logistics support, maintenance support manpower requirements, manpower computation, manpower matrix, material readiness, military bases, network preflight analysis, repair criteria, reparable items, SIMSCRIPT,

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Logistics Composite (LCOM II) simulation software is a composite of individual programs or modules written in SIMSCRIPT II which communicate directly with each other and function as a unit. This software was designed to apply simulation to studies concerning Air Force base level functions, e.g. operations, maintenance and supply. Through simulation the impact of the availability of all types of support resources on the operational status of a weapon system can be assessed. The LCOM II software together with the data representing a weapon system's environment from study models that permit the analysis of weapon

Over

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

19. (continued)

simulation, supply performance, Systems analysis, systems effectiveness, weapon support.'

20. (continued)

system support requirements. The LCOM II simulation software is composed of 3 distinct modules; the Input Module that preprocesses the data, the Main Module that conducts the simulation and the Post Processor Module that includes several individual post processor programs providing post simulation analysis and data displays. All modules of the LCOM II simulation software are described in detail, and a step by step approach for preparing the input forms is discussed.